(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 639 360 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
10.09.2014 Bulletin 2014/37

(21) Application number: **13171779.5**

(22) Date of filing: **13.07.2009**

(51) Int Cl.:
E02F 3/96 *(2006.01)* ***E02F 9/08*** *(2006.01)*
E02F 3/30 *(2006.01)* ***E02F 3/36*** *(2006.01)*
E02F 3/42 *(2006.01)*

(54) **Mobile apparatus**

Mobile Vorrichtung

Appareil mobile

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **14.07.2008 NL 1035694**
22.10.2008 NL 2002125

(43) Date of publication of application:
18.09.2013 Bulletin 2013/38

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
09798166.6 / 2 304 111

(73) Proprietor: **Hudson Bay Holding B.V.**
4458 SC's-Heer Arendskerke (NL)

(72) Inventor: **Huissoon, Leendert Wilhelmus Cornelis**
4458 SC 's-Heer Arendskerke (NL)

(74) Representative: **D'Halleweyn, Nele Veerle Trees Gertrudis**
Arnold & Siedsma
Sweelinckplein 1
2517 GK Den Haag (NL)

(56) References cited:
EP-A- 0 150 154
EP-A- 1 364 572
EP-A- 1 472 416
EP-A- 1 507 043
WO-A-89/11006
WO-A-2007/064700
DE-A1- 3 932 555
JP-A- 9 158 236
JP-A- 2007 278 044
NL-C1- 1 028 661
US-A- 5 265 995
US-A- 5 367 796
US-A1- 2003 074 811

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 2 639 360 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to a mobile apparatus for use in agriculture, forestry, in earth-moving and other operations such as pulling and driving farm machinery, digging and loading, lifting and displacing loads and so on. The present invention relates more particularly to a mobile apparatus which can perform more of these tasks, optionally simultaneously.

[0002] Known from the prior art are tractors which are typically provided with a three-point mounting for mounting a plough or other attachments thereon. Further known are so-called backhoe loaders which provide an excavator-loader combination on wheels. A backhoe loader is a vehicle similar to a tractor and having at the rear a digging arm and at the front a loading bucket. Finally, numerous excavators are known in which a digging arm is mounted on a rotatable sub-frame of the excavator.

[0003] US 5,265,995 discloses a front end loader and backhoe construction machinery vehicle. The vehicle comprises a front end stabilizing assembly upon a forward portion of the main frame. The front end stabilizing assembly comprises a third stabilizing arm pivotally mounted on the main frame adapted to be selectively operated by a hydraulic or other suitably powered cylinder means. Similarly, a fourth stabilizing arm is pivotally mounted on the main frame and is adapted to be selectively operated by a hydraulic or other suitably powered cylinder means. The vehicle further comprises a rear end stabilizing assembly.

[0004] The present invention has for its object to provide a mobile apparatus of the type stated in the preamble which allows more of the above stated tasks to be performed, optionally simultaneously, in practical manner using one and the same mobile apparatus.

[0005] The present invention is distinguished for this purpose by the features of claim 1. The mobile apparatus comprises:

- a main frame displaceable on displacing means;
- a sub-frame which is rotatable around a vertical axis and which is mounted on the main frame and provided with a control unit;
- at least one operating arm mounted on this sub-frame; and
- an automatically movable lifting device provided on the main frame, which lifting device is adapted to be connectable to an agricultural attachment. The lifting device is preferably a three-point lifting device.

[0006] The mobile apparatus can in this way be used for normal agricultural activities wherein a suitable agricultural attachment can be coupled to the lifting device while the operating arm mounted on the sub-frame can be used, optionally simultaneously, for other operations, typically digging/loading operations.

[0007] The multifunctional tractors of the prior art do not have a rotatable sub-frame and the operating arm must typically be uncoupled before an attachment coupled to the three-point lifting device can be used. This problem is solved by the invention by mounting the operating arm on a rotatable sub-frame while the lifting device is provided on the main frame.

[0008] The term "three-point lifting device" must be understood to mean a usual three-point lifting device as known on tractors, this three-point lifting device also been referred to with the terms three-point suspension or three-point coupling.

[0009] According to the preferred embodiment, the at least one operating arm comprises an articulated operating arm, and in particular a digging arm on the outer end of which an attachment can be mounted. The articulated operating arm more preferably consists of at least three articulations connected pivotally to each other, wherein the last articulation of the operating arm has a greater length than the penultimate one such that the articulations can be folded against each other, and the arm can be transformed from an articulated arm to a single lifting arm. Such embodiments are described in detail in the European patent EP 1 472 416 in the name of applicant, the text of which is incorporated herein by reference.

[0010] Other possible embodiments of the articulated arm are described in the European patents EP 1 245 739, EP 0 740 023 and EP 1 818 460 in the name of the Group Mecalac, and in the French patent FR 2 727 998, likewise in the name of Mecalac.

[0011] According to another possible embodiment, the at least one operating arm comprises a lifting arm, for instance a single or stereo/double arm. The at least one operating arm can further take a telescopic form.

[0012] According to a further aspect of the invention, the at least one operating arm can be mounted on the sub-frame for pivoting around a horizontal axis and/or a vertical axis. Such an assembly is likewise described in the above stated patent in the name of applicant, see in particular Fig. 4 and the related description.

[0013] According to the preferred embodiment, the mobile apparatus is a tractor. Within the scope of the present invention the term "tractor" must be interpreted broadly as a vehicle which can pull, push or tow something not having a drive of its own. Although the displacing means of a tractor are typically wheels, it is also possible in respect of the present invention to envisage caterpillar tracks or mechanical legs.

[0014] The mobile apparatus typically comprises one or more motors for driving the displacing means, the at least one operating arm and the lifting device. Examples of possible drive means are: petrol, diesel, biodiesel, ethanol, LPG, natural gas, hydrogen or electric motors; fuel cells, batteries etc., or a combination thereof. In the case of an embodiment with wheels, these can be steerable and/or driven. According to a possible embodiment, only a number of the wheels are steered and/or driven.

[0015] According to yet another aspect, the main frame can have a so-called articulated steering which is typical

for tractors, wheel loaders and loading buckets used in forestry or road construction. With an articulated steering a mobile apparatus can rotate in the middle, whereby it is possible to negotiate very tight bends. The rotation is made possible by a vertical or substantially vertical axis usually positioned between the axes of the wheels/caterpillar tracks. Four-wheel steering is also possible.

[0016] In the case of a caterpillar track drive, the invention comprises embodiments with two caterpillar tracks, but also embodiments with a plurality of caterpillar tracks, wherein for instance in an embodiment with wheels each of the wheels is replaced by a caterpillar track.

[0017] According to preferred embodiment, the drive means are mounted in the sub-frame. In the case of a motor, the motor will typically be mounted at the bottom of the sub-frame, while the fuel tank connected thereto can be mounted in the sub-frame or in the main frame.

[0018] According to a possible embodiment, the motor is mounted centrally at the rear of the sub-frame and a tank is mounted on either side thereof, which tank can be intended for fuel, hydraulic oil or any other liquid or gas necessary for driving. Other variants will be discussed hereinbelow with reference to the figures.

[0019] According to preferred embodiment of the invention, a feed for liquid and/or gas and/or electricity rotatable through 360° is provided between the rotatably mounted sub-frame and the main frame such that the lifting device, the displacing means and optional other components can be provided with the necessary energy. This energy can also be supplied to the different attachments via couplings close to the lifting device, often at the rear of the main frame or the sub-frame, although the front side is also an option.

[0020] The sub-frame is preferably provided with a driver's seat situated substantially in the centre, i.e. at half the width of the machine. In this way an operator will have a good view of the operations performed by the at least one operating arm. According to another possibility, the position of the operator can also be placed out of the centre, see for instance the embodiments described in the above stated patent in the name of applicant. The skilled person will appreciate that embodiments can likewise be envisaged without operator, wherein the mobile apparatus is remotely controlled.

[0021] According to a possible embodiment, the at least one operating arm is actuated as described in the Netherlands patent NL 1 028 661 in the name of applicant. The skilled person will once again appreciate that numerous other actuations are possible in accordance with the embodiment of the at least one operating arm.

[0022] In the case of a sub-frame with driver's seat, this can be embodied optionally with rollover protection, with a cab, with a fold-away or partially fold-away cab or with a convertible cab.

The main frame is further provided with one or more stabilizers such as jacks for the purpose of stabilizing the apparatus during specific operations, and in particular during the use of the at least one operating arm. According to one option, two stabilizers are provided at the rear which can be actuated via one or more actuating members such as hydraulic cylinders.

The stabilizers and the lifting device are combined, preferably at the rear, wherein a shared actuation is provided for the lifting device and the one or more stabilizers. The stabilizers are preferably removable, this such that the stabilizer can be removed or can be made more compact, and so leave space for agricultural attachments coupled to the lifting device.

[0023] An embodiment of the mobile apparatus can further be embodied with one or more stabilizers on the front side. According to a possible embodiment, a stabilizing element is provided on the front side which can be connected to an attachment, typically a loading bucket, which attachment can in this way function as stabilizing means, particularly on a soft ground surface.

[0024] According to yet another variant, a stabilizer can be formed by coupling an attachment such as a loading bucket to a quick change system connected to the main frame, this such that the quick change system with attachment forms a stabilizing platform. Such a quick change system can be of the same type as the system used on the outer end of operating arms for the purpose of coupling a digging or loading attachment thereto. It is also possible to use an adapter or quick change system of the skid steer of bobcat type, for instance in accordance with the SAE J 2513 norm.

[0025] According to the preferred embodiment of the mobile apparatus, the centre of gravity of the displaceable main frame lies lower than the top side of the displacing means, and the sub-frame has an underside with a recess, the form of which is adapted to extend over the displacing means, this such that the lowest point of the sub-frame lies lower than the top side of the displacing means and that the sub-frame can rotate freely without making contact with the displacing means. Such a design results in a stable mobile apparatus in which the rotatable sub-frame lies as low as possible, this in contrast to the prior art digging machines in which the rotatable subframe typically lies higher than the displacing means.

[0026] According to the embodiment in the form of a typical tractor with rear wheels which are larger than the front wheels, the main frame is preferably situated substantially between the front and rear wheels and the subframe has an underside with a recess, the form of which is adapted to extend over the rear wheels. The rotatable sub-frame will typically be embodied with a counterweight which can play a part as integrated wing or can function as a body in which a tank or a battery can be accommodated.

[0027] According to a further developed embodiment, the at least one operating arm is provided with a guiding adapted to move the attachment over a surface for working. In this way a loading bucket can follow the contours of the ground surface, this resulting in a tidy, smooth and efficient working.

[0028] It is further recommended to block the sub-frame relative to the main frame in specific situations, for instance:

- in an operative position of the at least one operating arm, typically a digging or load bucket position in the case of a digging/loading operating arm;
- in a situation wherein the operating arm threatens to rotate against a part of the main frame or the displacing means (in another variant the operating arm is automatically moved upward).

[0029] According to a further aspect of the invention, a control system can be provided for automatically guiding the rotation of the sub-frame and/or the movement of the at least one operating arm as a function of the steering of the displacing means. In this way the operating arm can for instance be placed automatically in the same direction as the travel direction. According to a further developed embodiment, the angle which the operating arm makes can be the same as the steering wheel movement, or be proportional to the steering wheel movement optionally as a function of the travel speed of the machine.

[0030] According to an embodiment, the mobile apparatus is provided on a front side with a pair of front wheels and on a rear side with a pair of rear wheels, wherein the front wheels are larger than or as large as the rear wheels.

[0031] According to an embodiment, the lifting device is provided on the front side or on the rear side, or on both the front side and the rear side.

[0032] According to an embodiment, the rear side is provided with a coupling system to which a counterweight, in particular a loading bucket, can be coupled.

[0033] According to an embodiment, the apparatus has a front side and rear side and a travel direction corresponding thereto, wherein the travel direction, and therefore also the front and rear sides, are reversible.

[0034] According to an embodiment, a switch which can be operated by a driver is provided for adjusting the travel direction.

[0035] According to an embodiment, the mobile apparatus is provided with steering means, such as a steering wheel or a joystick, wherein a signal manipulator such as a relay is further provided, which signal manipulator is coupled to the switch and to the steering means for controlling a steering member for moving the mobile apparatus in the travel direction set by the driver using the switch.

[0036] According to an embodiment, the mobile apparatus is provided with a forward/reverse switch, wherein the forward/reverse switch is likewise coupled to the signal manipulator for controlling the steering member for moving the mobile apparatus in the travel direction set by the driver using the switch, taking into account the position of the forward/reverse switch.

[0037] According to an embodiment, an additional attachment such as a mowing bar is mounted under the main frame.

[0038] According to an embodiment, the front and rear wheels operate at a different track width.

[0039] According to an embodiment, the track width of the wheels is adjustable and means for adjusting the track width are provided which can be operated by a driver.

[0040] According to an embodiment, braking and/or locking means are provided for limiting and/or locking the movement of the sub-frame relative to the main frame.

[0041] The present invention will be further elucidated on the basis of a number of non-limitative exemplary embodiments with reference to the accompanying drawing, in which:

Figures 1A to 1E show respectively a left side view, a rear view, a front view, a right side view and a top view of a first embodiment of a mobile apparatus according to the invention.

Figures 2A to 2D show different digging positions of an articulated arm of a second embodiment of a mobile apparatus according to the invention;

Figures 3A and 3B show a third embodiment of a mobile apparatus according to the invention, wherein agricultural attachments are coupled at the front and rear;

Figure 4A shows a fourth embodiment, wherein a trailer is coupled at the rear;

Figure 4B shows a fourth embodiment with a telescopic loading bucket arm;

Figure 5 shows a fifth embodiment with a digger bucket at the rear, this digger bucket being attached to the three-point lifting device;

Figures 6A to C show a sixth embodiment in which quick change systems are provided at the outer end of the operating arm and on the front side of the main frame;

Figure 7 shows a seventh embodiment with an operating arm with loading bucket;

Figure 8 illustrates a top view of an eighth embodiment with four-wheel steering;

Figures 9A and 9B illustrate a ninth embodiment with an adapter;

Figure 10 shows a side view of a tenth embodiment;

Figures 11A to 11C show respectively a schematic top view, side view and rear view of an eleventh embodiment according to the present invention, in which the location of the drive means is illustrated;

Figure 12 shows a top view of a twelfth embodiment;

Figures 13A to 13C show respectively a schematic top view, side view and rear view of a thirteenth embodiment according to the present invention;

Figures 14A and B show respectively a top view and a side view of a fourteenth embodiment in which a hybrid drive is used;

Figures 15A, B and C show respectively a top view, side view and rear view of a fifteenth embodiment according to the present invention;

Figures 16A and 16B show respectively a top view

and side view of a sixteenth embodiment;

Figures 17A to 17C show respectively a top view, a side view and a rear view of a seventeenth embodiment in which a fuel cell is used;

Figures 18A to 18C show respectively a top view, side view and rear view of an eighteenth embodiment;

Figures 19A to C show respectively a top view, side view and rear view of a nineteenth embodiment;

Figures 20A and B show respectively a top view and rear view of a twentieth embodiment;

Figures 21(A),(B),(C),(D),(E) show respectively a side view, a top view, a top view of a variant, a perspective view as seen from the front and a perspective view as seen from the rear of a twenty-first embodiment;

Figure 22 shows a side view of a twenty-second embodiment;

Figure 23 shows a side view of a twenty-third embodiment;

Figure 24 shows a side view of the twenty-fourth embodiment;

Figure 25(A) illustrates schematically the switching of the travel direction; and

Figure 25(B) illustrates schematically the switching of the travel direction and from forward to reverse.

[0042] Figures 1A to 1E show a first embodiment of a mobile apparatus according to the invention in the form of a tractor. Mobile apparatus 1 comprises a main frame 2 displaceable on wheels 4 and a sub-frame 3 mounted thereon for rotation round a vertical axis. Sub-frame 3 is provided with a driver's seat 5 and a number of steering elements, including joysticks 7, a steering wheel 6 and pedals 15. Main frame 2 is preferably situated as low as possible and in the shown embodiment lies substantially lower than the top side of front and rear wheels 4. Sub-frame 3 has a bottom side which lies lower than the top side of rear wheels 4 and is designed such that the sub-frame extends above rear wheels 4, wherein a recess 16 is provided in the bottom side such that the sub-frame can rotate freely without making contact with wheels 4.

[0043] As shown best in figure 1B and figure 1E, main frame 2 is provided on the rear side with a three-point lifting device. Such a lifting device is standard in agriculture and generally known to the skilled person, so detailed description thereof is not necessary. Further provided on the rear side of main frame 2 is a power takeoff shaft 12 (see figure 1B). In this way attachments coupled to the power takeoff can also be driven by the motor of the mobile apparatus. Such a power takeoff is generally known and will not be discussed in detail here. Note that such a power takeoff can also be provided on the front side of the mobile apparatus. A tow-hook 24 is further provided on the rear side of main frame 202.

[0044] An operating arm 10 with an attachment 11 is further mounted on sub-frame 3. In the shown embodiment operating arm 10 consists of an articulated arm on which a loading bucket 11 is mounted. The articulations of operating arm 10 are moved using a number of cylinders 17. The lower cylinder 17 is connected to the sub-frame by means of adjusting device 18. Attachment 11 is connected via a parallelogram hinge 19 to last cylinder 17. In this way the position of the attachment can be adjusted relative to the last articulation. Adjusting device 18 is used to optimize the geometry of actuating member 17 (or the actuating members in a multiple variant) relative to the articulation. In the loading bucket position (lowest position) the articulation can descend further downward due to the adjusting device and in the digging position (uppermost position) the articulation can be moved higher. The angle which the actuating member makes with the arm is then also better in the two different positions and thereby produces more force.

[0045] As shown best in figures 1B and 1E, the main frame is provided at the rear with two stabilizers 14 in the form of jacks. These stabilizers are preferably partially removable. In the shown embodiment the part of the jack located on the outside is slidable into a part of the jack lying closer to main frame 2, whereby the jack can be made shorter so as to leave space for agricultural attachments when they are coupled to three-point lifting device 13 or to power takeoff 12. Control members 20 are further provided for moving jacks 14.

[0046] Figures 2A to 2D show a second embodiment of a mobile apparatus according to the invention in four different positions. Similar components are designated with the same reference numeral, wherein 200 is added. Operating arm 210 has three articulations: 221, 222, 223 which are movable relative to each other using cylinders 217. Lower cylinder 217 is connected to sub-frame 203 using an adjusting device 218. In figure 2A the adjusting device is placed in the highest position. Provided at the rear of main frame 202 are stabilizers 214 embodied as described with reference to figures 1A to 1E. At the front of main frame 202 an additional stabilizer 214' is provided in the form of a loading bucket connected to a control member 220'. The loading bucket is in this way given a useful function when it is not in use. Figure 2B shows a position in which sub-frame 203 is rotated through about 90° such that operating arm 210 is situated at the side of the mobile apparatus. The arm is situated here in a digging position. Figure 2B further shows clearly that sub-frame 203 is provided with a recess 216 which allows free rotation of the sub-frame while the bottom side of the sub-frame lies considerably lower than the top side of the rear wheels of the mobile apparatus. The geometry of adjusting device 218 is further typically adapted to the geometry of the sub-frame such that they do not make contact with each other during rotation.

[0047] As best shown in figure 2D, sub-frame 203 is preferably dimensioned such that the counterweight in the form of a wing on the rear side of the sub-frame (see no. 213) extends substantially no further than jacks 214. In this way the mobile apparatus remains completely stable during digging.

[0048] Figure 2C further shows the position in which sub-frame 203 is rotated through 180° such that the digging arm is situated on the rear side of the mobile apparatus. In this way the second embodiment according to the invention can be used as a backhoe loader. Finally, figure 2D shows sub-frame 203 rotated through substantially 90° to the other side compared to figure 2B.

[0049] Figures 3A and 3B show a third embodiment of a mobile apparatus according to the invention in which agricultural attachments are coupled on the front and rear side. The same reference numerals as in figures 1A to 1E are once again used, wherein 300 is added. On the front side an agricultural attachment 326 is coupled to the outer end of operating arm 310. Operating arm 310 is connected to sub-frame 303 which is rotatably mounted on main frame 302. At the rear of the mobile apparatus an agricultural attachment 325 is connected to the three-point lifting device 313. Agricultural attachment 325 is further driven via power takeoff 312.

[0050] Figure 4A shows a fourth embodiment wherein a trailer 427 is connected to tow-hook 424. Figure 4B shows the same embodiment without trailer, with an operating arm 410 in the form of a telescopic arm with two parts 421, 422 which can slide into each other. An attachment 411 is coupled to the outer end of telescopic arm 410.

[0051] Figure 5 shows a fifth embodiment with a digger bucket 528 connected at the rear to main frame 502. When the machine is in the load bucket position (wherein the operating arm functions as a single lifting arm with a loading bucket 511 on its outer end) and is used as loading bucket or so-called tool carrier, it can then be useful to also carry the digger bucket 528 at the same time. It may after all be the case that digging will once again be necessary at another location on the workplace. Digger bucket 528 can then be readily uncoupled and mounted once again on the operating arm. During digging the loading bucket 511 can be used as support point at the front, see figure 2A. The lifting device therefore has solely the function as support here, although this is now useful since the lifting device can itself also lift the bucket.

[0052] Figures 6A to 6C further show an embodiment with yet another variant of a stabilizer on the front side. The front side is provided with a quick change system 629 to which an attachment can be coupled. Quick change system 629 is controlled using a control member 629'. In figures 6B and 6C can be seen how a bucket 614' can be used as extra stabilizer on the front side.

[0053] Figure 7 shows a seventh embodiment which is the same as the first embodiment, with the difference that a loading bucket 711 is coupled to operating arm 710, wherein the operating arm is in the folded position and therefore functions as a single lifting arm.

[0054] Figure 8 shows an embodiment with steered front and rear wheels 804, 804'. Figure 8 further illustrates how sub-frame 803 co-rotates in the steering direction of the front wheels. The skilled person will appreciate that this co-rotation can further depend on other variables in addition to the direction of the front wheels.

[0055] Figures 9A and 9B show a ninth embodiment in which an adapter is mounted on the quick change system. Such an adapter 930 allows the mounting of other attachments. Other attachments are for instance: attachments used mainly on skid steers, such as a driven snow shovel, a rotating brush, a dozer blade, a concrete mixer and so on.

[0056] According to a variant the machine has no adapter, but the attachments are then mounted via a separate quick change system.

[0057] Finally, figure 10 shows an embodiment with a normal digging arm 1010 with a first guide 1021 in the form of a curved arm.

[0058] Figures 11A to C illustrate the arrangement of the different components necessary for driving the wheels and the operating arm and possible other components such as the stabilizers, the power takeoff etc. in an embodiment of a mobile apparatus according to the invention. As shown in figure 11A, motor 1244 is arranged centrally in sub-frame 1203. Tanks 1241, 1242 are arranged on either side of motor 1244. Such a tank can for instance be intended for storing hydraulic oil or for storing fuel or for storing another liquid or gas. Motor 1244 is typically a combustion engine but can also be any other type of motor. One or more pumps 1240, typically liquid pumps, can further be provided in sub-frame 1203. A cooling element or radiator 1243 is also provided on the rear side of motor 1244. A feed 1245 rotatable through 360° for liquid and/or gas and/or electricity lines is provided between sub-frame 1203 and main frame 1202.

[0059] As best shown in figures 11B and 11C, the motor is preferably mounted as low as possible in sub-frame 1203. A great stability is in this way obtained.

[0060] Figure 12 illustrates another possible embodiment in which elements 1241 to 1244 are arranged at a determined angle compared to the embodiment of figures 11A to C.

[0061] Figures 13A to C illustrate another variant for arranging the drive means in an embodiment of the mobile apparatus according to the invention. In this embodiment tanks 1341, 1342 are placed further forward and a cooling element 1343 and pumps 1340 are arranged on either side of motor 1344. Such an embodiment will once again result in a stable construction.

[0062] Figures 14A and B show an embodiment similar to that in figures 13A to C, but for a hybrid drive. Tanks 1441 and 1442 are here liquid or gas tanks and, in addition to liquid pump 1440, an additional drive unit, for instance a generator unit 1447, is provided. Further provided is a storage capacity for electricity such as a battery 1446.

[0063] Figures 15A to C show a hybrid drive unit, the components of which are distributed over the sub-frame and the main frame. In the shown embodiment motor 1544 is arranged in the sub-frame, while tanks 1541 and 1542 are arranged in the main frame. Pump 1540, generator unit 1547 and the electricity storage capacity 1546

are further likewise accommodated in the sub-frame.

[0064] Figures 16A and B show an embodiment of a drive with a fuel cell in which the fuel cell is stored either centrally 1648 in the sub-frame or at the rear of sub-frame 1647. According to a variant on the electricity storage unit can be stored centrally 1648 or at the rear of sub-frame 1647. Tanks 1641, 1642 are once again provided in the main frame.

[0065] Figures 17A to C show yet another variant with fuel cell, wherein all the discussed components of the drive means are located in the sub-frame. The fuel cell unit or storage capacity unit 1748 is more particularly situated centrally in the sub-frame with a tank 1741, 1742 on either side thereof. The electricity storage capacity or fuel cell 1747 and cooling unit 1743 are further situated at the rear in the sub-frame.

[0066] Figures 18A to 18C show yet another variant with fuel cells and electricity storage unit, wherein these components are distributed over elements 1847, 1848 and 1849 and 1850. Units 1849 and 1850 are situated in the main frame, on two outer sides thereof. Unit 1848 is situated centrally in the sub-frame and unit 1847 is situated at the rear in the sub-frame.

[0067] According to another variant illustrated in figures 19A to 19C, the mobile unit can be driven wholly electrically or wholly via fuel cells. In the embodiment of figures 19A to 19C the components 1947, 1949, 1950 can all be electricity storage units or all fuel cell units. Units 1949, 1950 are situated in the main frame as far as possible toward the outside between the front and rear wheels. Unit 1947 is situated at the rear in the sub-frame.

[0068] Finally, figures 20A and 20B show a further variant with one fuel cell 2048 and two electricity storage units 2049, 2050. Storage units 2049, 2050 are provided in the main frame, while fuel cell 2048 is provided in the sub-frame. Tank 2041, 2042 are further provided on either side of the centrally mounted fuel cell 2048. Finally, the sub-frame is provided at the rear with a cooling unit 2043.

[0069] Figures 21(A)-(E) further illustrate another important variant, wherein the larger wheels 2004 are provided at the front instead of at the rear, i.e. the side of the three-point lifting device 2013 in figures 21(A)-(E). The small wheels 2004' are then provided at the rear. The other components of this embodiment resemble those of the embodiment of figures 1(A)-(E) and will not be discussed again in detail here. Similar components are designated with the same reference numerals, with 2000 added.

[0070] Mobile apparatus 2001 has a rotatable sub-frame 2003 so that the driver/operator can select the travel direction or, in other words, can choose which side functions as front side in which as rear side. The driver can herein position the articulated arm or the single lifting arm 2010 on that side where it is most effective. The reason for opting to operate with large wheels 2004 at the front may for instance be to reduce the ground pressure. In determined cases this may moreover have the additional advantage that a greater steering angle of the steered wheels is thereby possible. At higher speeds of the mobile apparatus it may then be recommended to return the machine to the position with small wheels at the front.

[0071] As illustrated in figure 21(B), the mobile apparatus can be embodied in accordance with a variant such that the most steered wheels, the small wheels 2004', are on the rear side. It is also possible - see figure 21(C) - that only the rear axle with small wheels 2004' is steered and that the front axle with large wheels 2004 is not steered.

[0072] Note that in yet another embodiment all wheels can be of the same size.

[0073] In order to ensure that the driver can choose between two possible travel directions, a switch is for instance provided which switches the steering wheel movement of all four wheels and/or of only the steered wheels (see for instance the variant of figure 21(C)). Figure 25(A) shows schematically how this switch in travel direction, or of front and rear side, and so also of steering direction, can be realized. Shown in this figure is a steering wheel 2501 which is coupled to a technical device, for instance an orbit roll 2502, which converts the rotating steering signal into an electrical/pneumatic or hydraulic signal. This signal is for instance converted by a manipulator 2503, wherein manipulator 2503 is adjusted using a switch 2504. This switch 2504 is typically arranged close to the driver's seat or where the driver sits or stands. Single manipulator 2503 can for instance be an electric relay, but can also be a pneumatic or hydraulic steering slide or valve. This manipulator transmits the signal to an actuating member, here for instance a pneumatic or hydraulic cylinder 2505. This can for instance also be an electrically driven spindle which realizes the angular adjustment of the front wheels and/or the rear wheels.

[0074] In the shown situation switch 2004 is in the rest position. Here the travel direction is forward as indicated on the left in the figure, with the front side on the side of the small wheels. At a switch-over forward becomes reverse, and the front side thus becomes the side with the large wheels.

[0075] According to another embodiment variant, the steering wheel can be replaced by a joystick which will determine the steering angle of the wheels.

[0076] If the driver changes the travel direction via switch 2504, it is then almost essential in practice to switch operation of forward and reverse. The driver is after all accustomed to choosing between forward and reverse because there is a front and a rear side of the machine. If however these sides are switched, it is then recommended to also switch the operation of forward and reverse in order to avoid confusion.

[0077] Figure 25(B) shows schematically how this switch-over is effected. In the prior art apparatus a switch between forward and reverse 2508 is typically provided in the vicinity of driver 2508. This switch 2508 is for instance on the right-hand joystick, or can be a foot pedal

or even multiple foot pedals. This switch 2508 is likewise used to adjust manipulator 2503. If the travel direction, and so front side and rear side, are now reversed, the travel direction of the motor 2507 will then also be reversed via manipulator 2503. In this way switch 2508 thus continues to retain its function, and forward is the direction which at that moment is indicated as forward by switch 2504.

[0078] As illustrated in figure 22, it is likewise possible to position an attachment, such as for instance a mowing bar 2230, under the machine between the axles. In this way both the lifting device and the operating arm are still available. Similar components are designated with the same reference numerals as in figures 1(A)-(E), wherein 2200 is added.

[0079] If the operating arm is used as loading bucket or other attachment such as a pallet fork 2311 (see figure 23) on the side of the large wheels, it is possible to place a counterweight 2314 in the quick change device 2329. An example is shown in figure 23, wherein similar components are designated with the same reference numerals as in figures 1(A)-(E), wherein 2300 is added. In this position it is also possible to use a loading bucket 2414 as counterweight as illustrated in figure 24, wherein similar components are designated with the same reference numerals as in figures 1(A)-(E), wherein 2400 is added.

[0080] According to another embodiment variant (not shown), it is possible to mount a three-point lifting device only on the side of the small wheels, and in yet another embodiment variant it is possible to have a three-point lifting device at both the front and rear, wherein hydraulic conduits are available on each side for additional functions. This latter variant has the advantage that more attachments can be coupled simultaneously to the machine.

[0081] In another further developed embodiment variant it is possible to have the front wheels and the rear wheels operate on a narrower track. It hereby becomes possible to also drive on narrow paths, or for instance between fruit trees or in vineyards. The driver can then preferably choose between a normal width track or a narrower track. In another variant thereof it is possible to have the front axle operate at a track width other than the rear axle. The advantage is that in this way only one wheel drives over the ground surface, and less damage is therefore caused to the ground.

[0082] Finally, yet another variant consists of limiting the rotation of the sub-frame, or of fixing the sub-frame. This is possible with a mechanical or hydraulic or other type of brake or by a mechanical locking. This may for instance be useful in practice during mowing of verges or trimming of hedges. The mowing bar or hedge cutters are here fixed to the outer end of the articulated arm or the loading bucket arm. The machine then moves forward at a determined speed. If no rotation locking or brake is arranged, there is then the possibility that due to increased resistance of the attachment - in a direction opposite to the travel direction - the sub-frame will begin to rotate. This is then prevented by a brake or a locking on the rotation device of the sub-frame.

[0083] The skilled person will appreciate that the present invention is not limited to the above described exemplary embodiments, and that many variants can still be envisaged which fall within the scope of the invention, the scope being defined solely by the following claims.

Claims

1. Mobile apparatus (1), comprising

- a main frame (2) displaceable on displacing means;
- a sub-frame (3) which is rotatable around a vertical axis and which is mounted on the main frame and provided with a control unit;
- at least one operating arm (10) mounted on the sub-frame; and
- an automatically movable lifting device (13) provided on the main frame, which lifting device is adapted to be connectable to an agricultural attachment; wherein the main frame is provided with one or more stabilizers (14, 214, 614, 614') for the purpose of stabilizing the apparatus during the use of the at least one operating arm; and

characterized in that a number of stabilizers (14, 214, 614) of said one or more stabilizers and the lifting device (13) are provided on the same side of the apparatus (1), and that a shared actuation is provided for these stabilizers (14, 214, 614) and the lifting device (13).

2. Mobile apparatus as claimed in claim 1 having a front side and a rear side and a travel direction corresponding thereto, **characterized in that** the lifting device (13) is arranged at the front side.

3. Mobile apparatus as claimed in claim 1 or 2 with at least one motor for driving at least the displacing means, **characterized in that** the mobile apparatus is provided with a power takeoff (12) coupled to the at least one motor for driving additional attachments, typically agricultural attachments.

4. Mobile apparatus as claimed in claim 3, wherein the power takeoff (12) is arranged at the same side of the mobile apparatus as the lifting device (13).

5. Mobile apparatus as claimed in any of the previous claims, **characterized in that** the lifting device (13) is a three-point lifting device.

6. Mobile apparatus as claimed in any of the previous claims, **characterized in that** the main frame (2) is provided with a stabilizing coupling adapted to be

coupled to an attachment, typically a loading bucket (214').

7. Mobile apparatus as claimed in any of the previous claims, **characterized in that** a quick change system (629) is connected to the main frame for the purpose of coupling a digging or loading attachment thereto.

8. Mobile apparatus of claim 7, **characterized in that** a quick change system of the same type is connected to an outer end of an operating arm (10).

9. Mobile apparatus as claimed in any one of the previous claims, **characterized in that** the at least one operating arm (10) comprises any one of the following:

an articulated operating arm, on the outer end of which an attachment is mounted; or
a double arm; or a telescopic arm.

10. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the drive means for at least the displacing means (4) and the operating arm (10) are mounted in the sub-frame (3).

11. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the displacing means are one of the following: wheels, caterpillar tracks, mechanical legs.

12. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the centre of gravity of the displaceable main frame (2) lies lower than the top side of the displacing means (2), and that the sub-frame (3) has an underside with a recess, the form of which is adapted to extend over the displacing means, this such that the lowest point of the sub-frame lies lower than the top side of the displacing means and that the sub-frame can rotate freely without making contact with the displacing means.

13. Mobile apparatus as claimed in claim 12, **characterized in that** the mobile apparatus is provided with a pair of rear wheels and a pair of front wheels, wherein the rear wheels are larger than the front wheels; and that the displaceable main frame (2) is situated between the front and rear wheels, and that the sub-frame (3) has an underside with a recess, the form of which is adapted to extend over the rear wheels, this such that the lowest point of the sub-frame lies lower than the top side of the rear wheels.

14. Mobile apparatus as claimed in any of the foregoing claims, **characterized in that** the apparatus has a front side and rear side and a travel direction corresponding thereto, wherein the travel direction, and therefore also the front and rear sides, are reversible.

15. Mobile apparatus as claimed in claim 14, **characterized in that** there is provided a switch (2504) which can be operated by a driver for adjusting the travel direction; and **in that** there is provided a steering means and a signal manipulator coupled to the switch and to the steering means for controlling the steering means for moving the mobile apparatus in the travel direction set by the driver using the switch.

Patentansprüche

1. Mobile Vorrichtung (1) mit

- einem Hauptrahmen (2), der auf einer Verlagerungseinrichtung verlagerbar ist,
- einem Unterrahmen (3), der drehbar um eine Vertikalachse ist und auf dem Hauptrahmen montiert ist und mit einer Steuereinheit versehen ist,
- zumindest einem Betriebsarm (10), der auf dem Unterrahmen montiert ist, und
- einer automatisch bewegbaren Vorrichtung (13), die auf dem Hauptrahmen vorgesehen ist, wobei die Hubvorrichtung ausgebildet ist, um mit einer landwirtschaftlichen Anbauvorrichtung verbindbar zu sein, wobei der Hauptrahmen mit einem oder mehreren Stabilisatoren (14, 214, 614, 614') zum Stabilisieren der Vorrichtung während des Gebrauchs des zumindest einen Betriebsarms versehen ist, und **dadurch gekennzeichnet, dass** eine Anzahl von Stabilisatoren (14, 214, 614) des einen oder der mehreren Stabilisatoren und der Hubvorrichtung (13) auf derselben Seite der Vorrichtung (1) vorgesehen sind und dass eine gemeinsame Betätigung für diese Stabilisatoren (14, 214, 614) und die Hubvorrichtung (13) vorgesehen ist.

2. Mobile Vorrichtung nach Anspruch 1 mit einer Vorderseite und einer Rückseite und einer Bewegungsrichtung, die damit korrespondiert, **dadurch gekennzeichnet, dass** die Hubvorrichtung (13) an der Vorderseite vorgesehen ist.

3. Mobile Vorrichtung nach Anspruch 1 oder 2 mit zumindest einem Motor zum Betreiben von zumindest der Verlagerungseinrichtung, **dadurch gekennzeichnet, dass** die mobile Vorrichtung mit einer Zapfwelle (12) versehen ist, die mit dem zumindest einem Motor verbunden ist, zum Betreiben zusätzlicher Anbauvorrichtungen, typischerweise landwirtschaftlicher Anbauvorrichtungen.

4. Mobile Vorrichtung nach Anspruch 3, wobei die Zapfwelle (12) auf derselben Seite der mobilen Vorrich-

tung wie die Hubvorrichtung (13) vorgesehen ist.

5. Mobile Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Hubvorrichtung eine Dreipunkt-Hubvorrichtung ist.

6. Mobile Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der Hauptrahmen (2) mit einer Stabilisationskupplung versehen ist, die ausgebildet ist, mit einem Zubehörteil, typischerweise einer Ladeschaufel (214') verbunden zu werden.

7. Mobile Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** ein Schnellwechselsystem (629) mit dem Hauptrahmen verbunden ist, um ein Grabungs- oder Ladezubehörteil damit zu verbinden.

8. Mobile Vorrichtung nach Anspruch 7, **dadurch gekennzeichnet, dass** ein Schnellwechselsystem desselben Typs mit einem äußeren Ende des Betriebsarms (10) verbunden ist.

9. Mobile Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der zumindest eine Betriebsarm (10) irgendetwas des folgenden aufweist:

einen landwirtschaftlichen Betätigungsarm, an dessen äußeren Ende ein Zubehörteil montiert ist, oder
einen Doppelarm oder einen Teleskoparm.

10. Mobile Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** das Antriebsmittel für die zumindest eine Verlagerungseinrichtung (4) und den Betriebsarm (10) in dem Unterrahmen (3) montiert ist.

11. Mobile Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Verlagerungseinrichtung eins des folgenden ist: Räder, Raupenkettenspuren, mechanische Beine.

12. Mobile Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** der Schwerpunkt des verlagerbaren Hauptrahmens (2) tiefer liegt als die Oberseite der Verlagerungseinrichtung (2) und dass der Unterrahmen (3) eine Unterseite mit einer Ausnehmung aufweist, deren Form ausgebildet ist, sich über die Verlagerungseinrichtung zu erstrecken, derart, dass der unterste Punkt des Unterrahmens tiefer liegt als die Oberseite der Verlagerungseinrichtung und dass der Unterrahmen frei drehen kann, ohne in Kontakt mit der Verlagerungseinrichtung zu kommen.

13. Mobile Vorrichtung nach Anspruch 12, **dadurch gekennzeichnet, dass** die mobile Vorrichtung mit einem Paar Hinterräder und einem Paar Vorderräder versehen ist, wobei die Hinterräder größer als die Vorderräder sind, und dass der verlagerbare Hauptrahmen (2) zwischen den Vorder- und den Hinterrädern angeordnet ist und dass der Unterrahmen eine Unterseite mit einer Ausnehmung aufweist, deren Form angepasst ist, sich über die Hinterräder zu erstrecken derart, dass der unterste Punkt des Unterrahmens tiefer liegt als die Oberseite der Hinterräder.

14. Mobile Vorrichtung nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Vorrichtung eine Vorderseite und eine Rückseite aufweist und eine damit entsprechende Bewegungsrichtung, wobei die Bewegungsrichtung und somit auch die Vorder- und Rückseiten reversibel sind.

15. Mobile Vorrichtung nach Anspruch 14, **dadurch gekennzeichnet, dass** ein Schalter (2504) vorgesehen ist, der durch einen Fahrer zum Einstellen der Bewegungsrichtung betätigt werden kann, und dass eine Steuereinrichtung vorgesehen ist und ein Signalmanipulator, der mit dem Schalter und der Steuereinrichtung verbunden ist, zum Steuern der Steuereinrichtung und zum Bewegen der mobilen Vorrichtung in der Bewegungsrichtung, die durch den Fahrer, der den Schalter benutzt, eingestellt wird.

Revendications

1. Dispositif mobile (1), comprenant :

un châssis principal (2) pouvant être déplacé sur un moyen de déplacement ;
un châssis secondaire (3) qui peut tourner autour d'un axe vertical et qui est monté sur le châssis principal et comporte une unité de commande ;
au moins un bras d'activation (10) monté sur le châssis secondaire ; et
un dispositif de levage pouvant être déplacé automatiquement (13) agencé sur le châssis principal, lequel dispositif de levage est adapté de manière à être raccordé à un outillage agricole ; dans lequel le châssis principal comporte un ou plusieurs stabilisateurs (14, 214, 614, 614') dans le but de stabiliser le dispositif au cours de l'utilisation du ou des bras d'activation ; et
caractérisé en ce qu'un certain nombre de stabilisateurs (14, 214, 614) du ou desdits stabilisateurs et le dispositif de levage (13) sont agencés du même côté du dispositif (1) et **en ce qu'**une activation partagée est assurée pour ces

stabilisateurs (14, 214, 614) et le dispositif de levage (13).

2. Dispositif mobile selon la revendication 1, présentant une face avant et une face arrière et un sens de déplacement correspondant à celles-ci, **caractérisé en ce que** le dispositif de levage (13) est agencé sur la face avant.

3. Dispositif mobile selon la revendication 1 ou 2, avec au moins un moteur afin d'entraîner au moins le moyen de déplacement, **caractérisé en ce que** le dispositif mobile comporte une prise de force (12) couplée au ou aux moteurs de manière à entraîner des outillages supplémentaires, en général, des outillages agricoles.

4. Dispositif mobile selon la revendication 3, dans lequel la prise de force (12) est agencée sur le même côté du dispositif mobile que le dispositif de levage (13).

5. Dispositif mobile selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le dispositif de levage (13) est un dispositif de levage à trois points.

6. Dispositif mobile selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le châssis principal (2) comporte un dispositif de couplage de stabilisation adapté de manière à être couplé à un outillage, en général, un godet de chargement (214').

7. Dispositif mobile selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**un dispositif de changement rapide (629) est raccordé au châssis principal dans le but de coupler à celui-ci un outillage destiné à creuser ou charger.

8. Dispositif mobile selon la revendication 7, **caractérisé en ce qu'**un dispositif de changement rapide du même type est raccordé à une extrémité externe d'un bras d'activation (10).

9. Dispositif mobile selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le ou les bras d'activation (10) comportent l'un quelconque de ce qui suit :

un bras d'activation articulé, sur l'extrémité externe duquel est monté un outillage ; ou
un double bras ; ou un bras télescopique.

10. Dispositif mobile selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les moyens d'entraînement pour au moins le moyen de déplacement (4) et le bras d'activation (10) sont montés sur le châssis secondaire (3).

11. Dispositif mobile selon l'une quelconque des revendications précédentes, **caractérisé en ce que** les moyens de déplacement sont l'un des suivants : des roues, des chenilles, des jambes mécaniques.

12. Dispositif mobile selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le centre de gravité du châssis principal pouvant être déplacé (2) est situé plus bas que la face supérieure du moyen de déplacement (2), et **en ce que** le châssis secondaire (3) présente une face inférieure avec une cavité dont la forme est adaptée de manière à s'étendre au-dessus du moyen de déplacement, ceci de manière à ce que le point le plus bas du châssis secondaire se situe au-dessous de la face supérieure du moyen de déplacement et à ce que le châssis secondaire puisse tourner librement sans entrer en contact avec le moyen de déplacement.

13. Dispositif mobile selon la revendication 12, **caractérisé en ce que** le dispositif mobile comporte une paire de roues arrière et une paire de roues avant, dans lequel les roues arrière sont plus larges que les roues avant ; et **en ce que** le châssis principal pouvant être déplacé (2) est situé entre les roues avant et arrière, et **en ce que** le châssis secondaire (3) présente une face inférieure avec une cavité, dont la forme est adaptée de manière à s'étendre au-dessus des roues arrière, ceci de telle sorte que le point le plus bas du châssis secondaire se trouve plus bas que la face supérieure des roues arrière.

14. Dispositif mobile selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le dispositif comporte une face avant et une face arrière et un sens de déplacement correspondant à celles-ci, dans lequel le sens de déplacement et, par conséquent, également les faces avant et arrière, sont réversibles.

15. Dispositif mobile selon la revendication 14, **caractérisé en ce qu'**il est prévu un commutateur (2504) qui peut être commandé par un conducteur afin d'ajuster le sens de déplacement ; et
en ce qu'il est prévu un moyen de direction et un dispositif de manipulation de signal couplé au commutateur et au moyen de direction afin de commander le moyen de direction de manière à déplacer le dispositif mobile suivant le sens de déplacement défini par le conducteur en utilisant le commutateur.

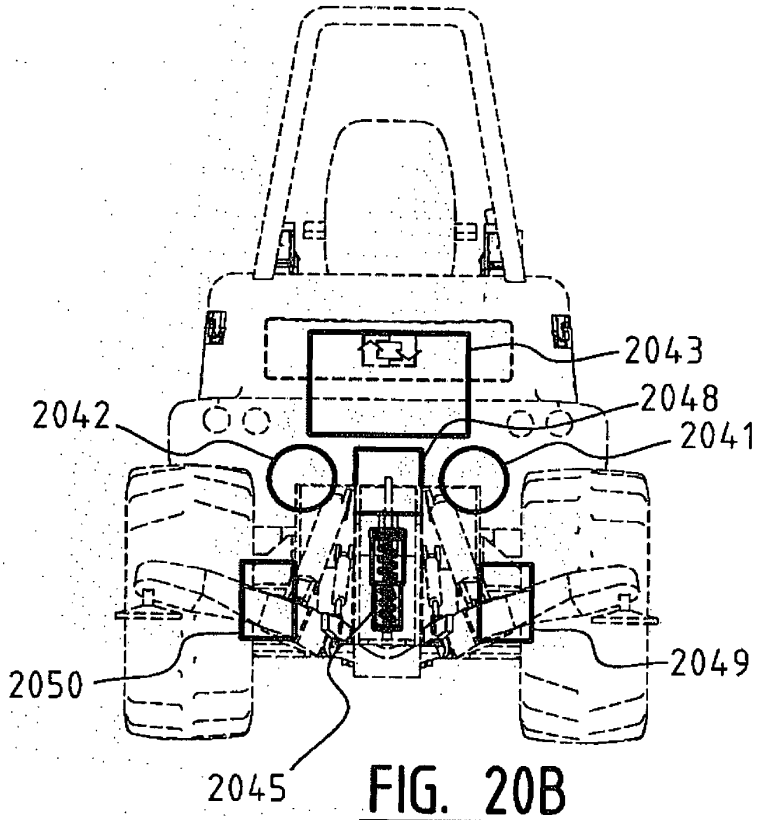


FIG. 20B

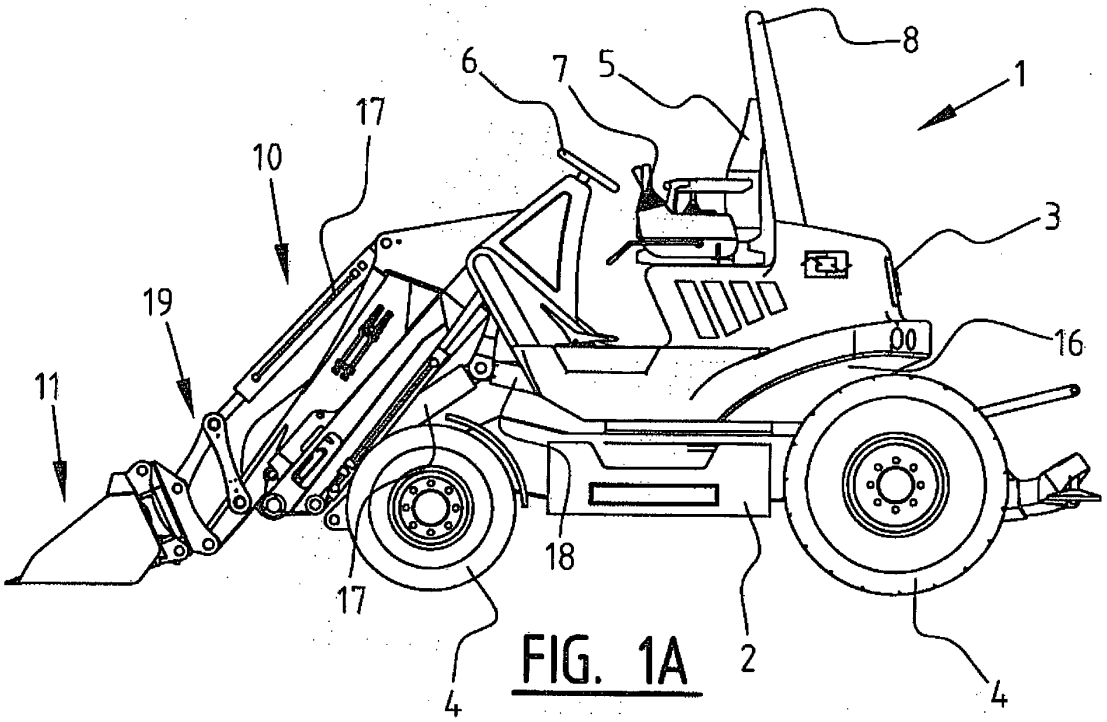


FIG. 1A

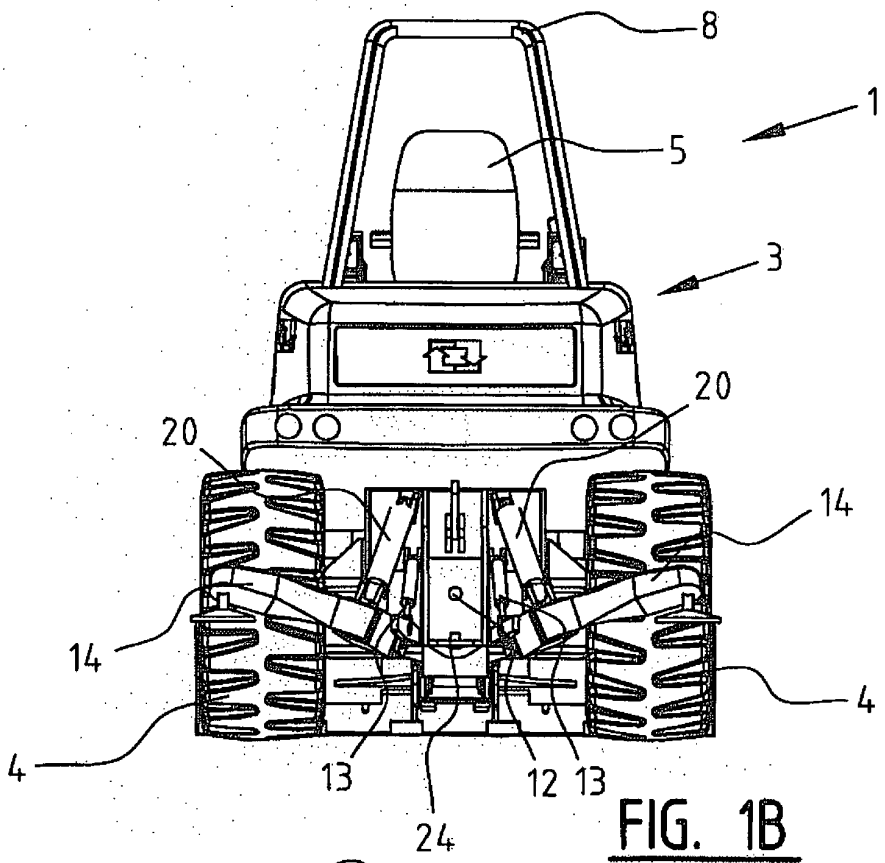


FIG. 1B

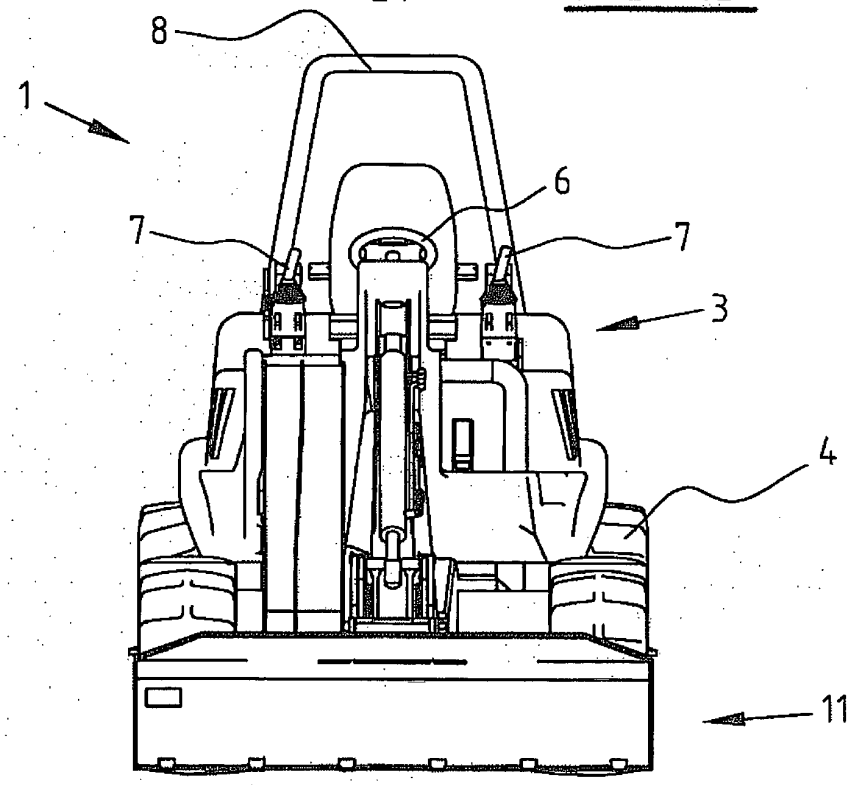


FIG. 1C

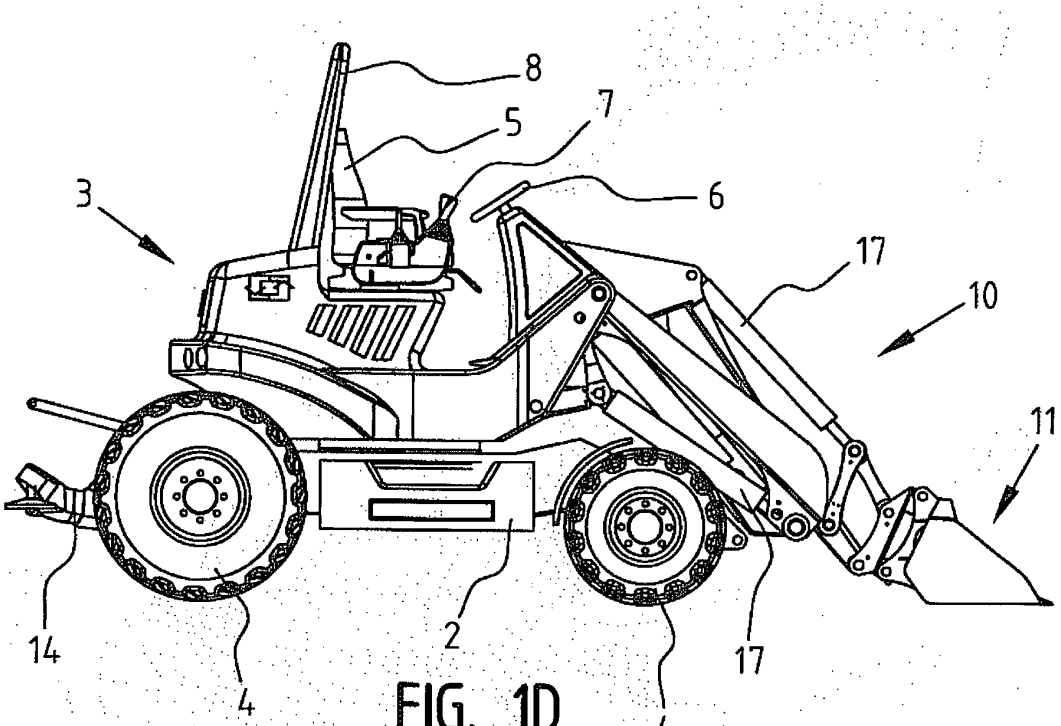


FIG. 1D

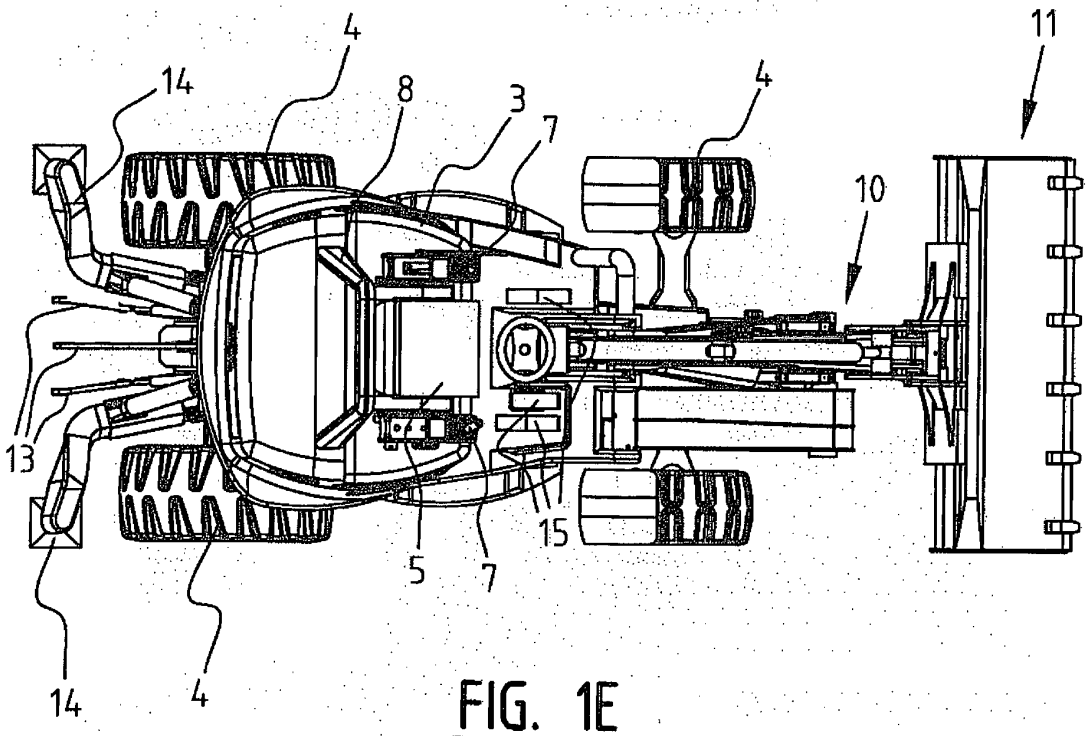


FIG. 1E

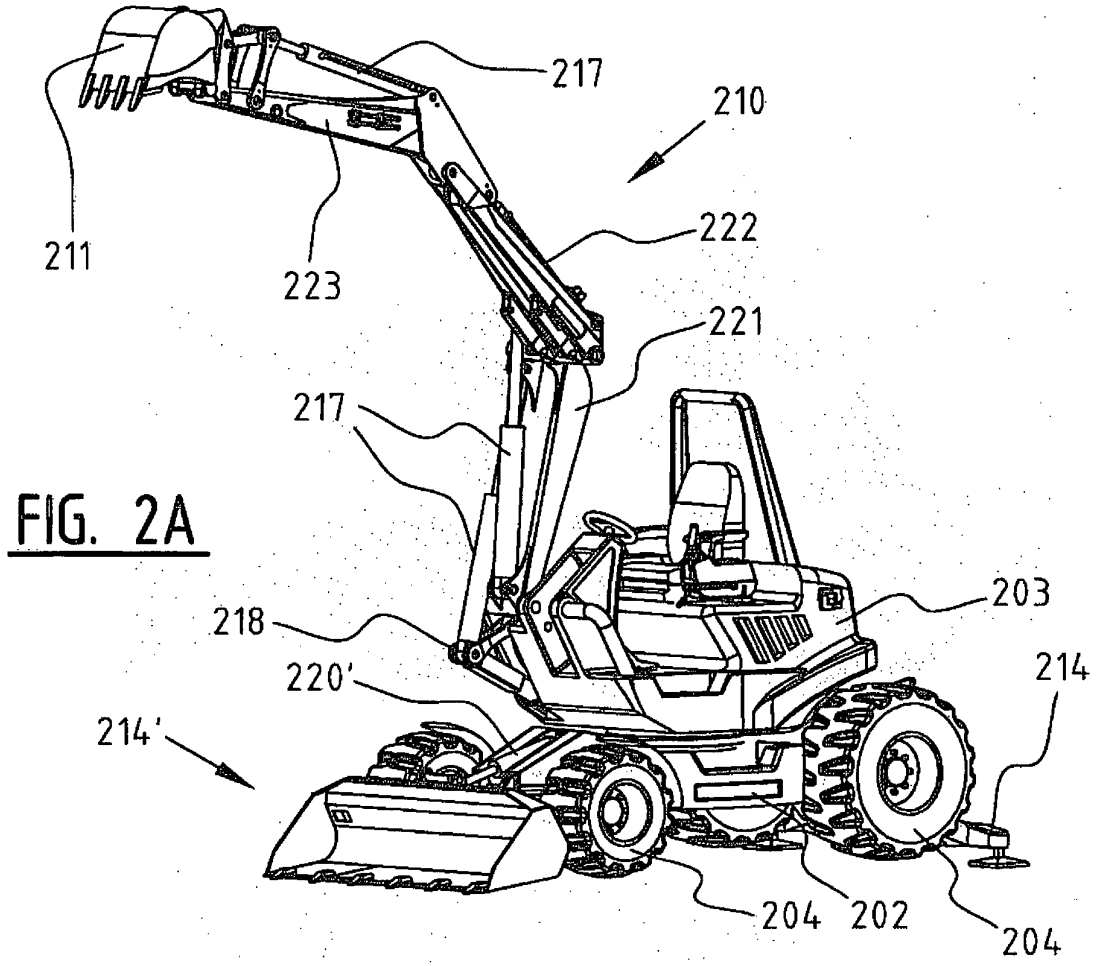

217
210
211
222
223
221
217
218
203
220'
214
214'
204
202
204

FIG. 2A

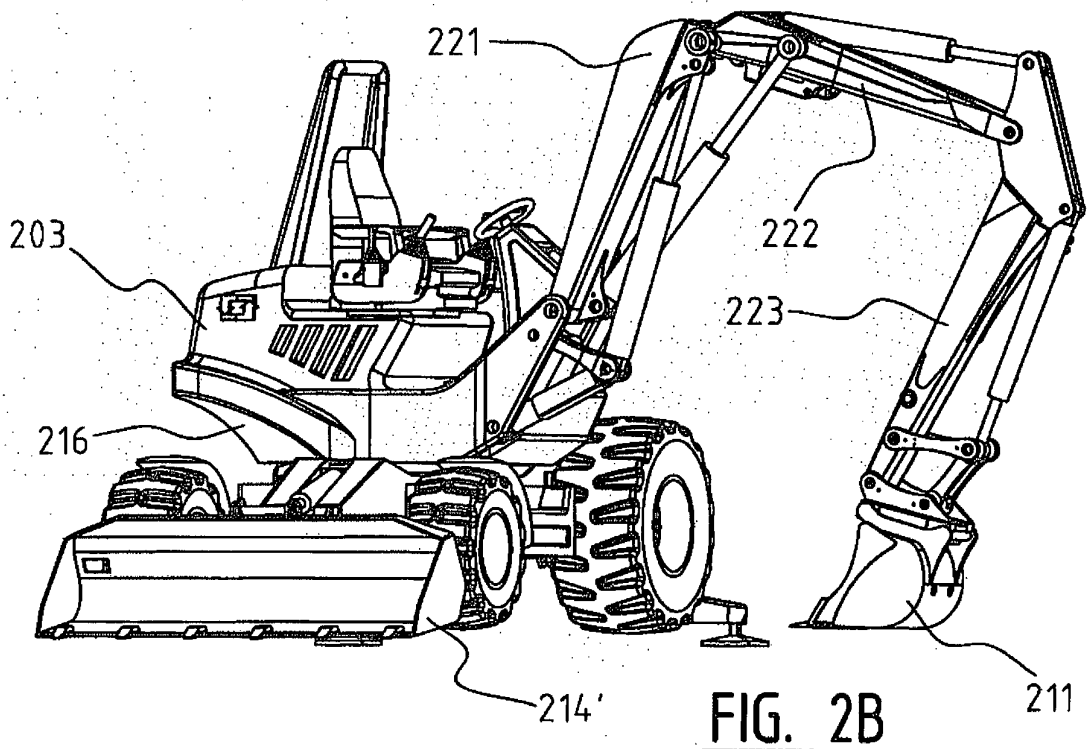

221
203
222
223
216
214'
211

FIG. 2B

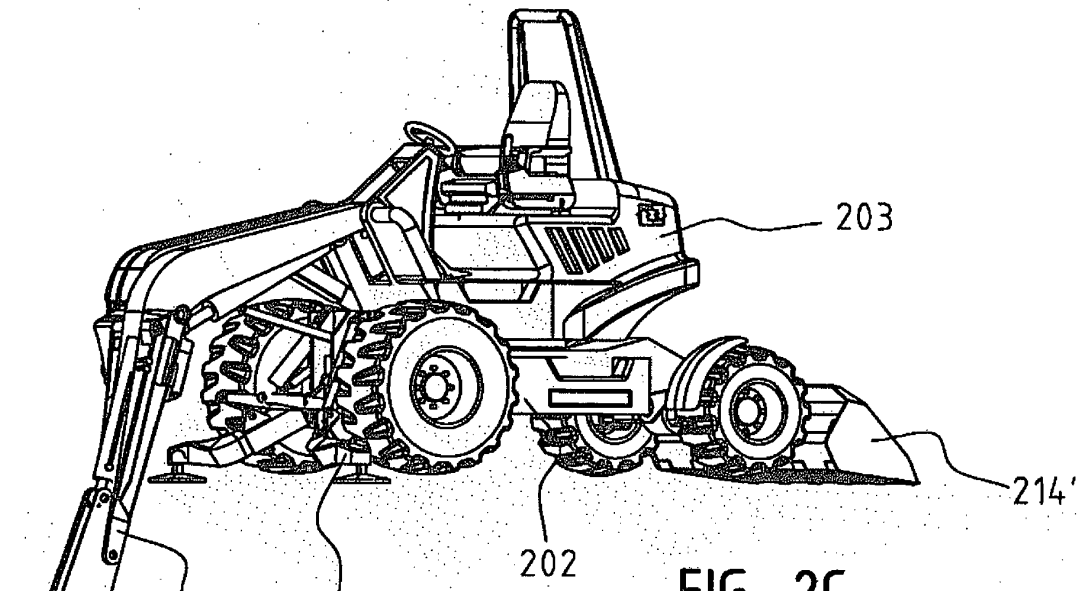

203
214'
202
214
222
210
219
223
211

FIG. 2C

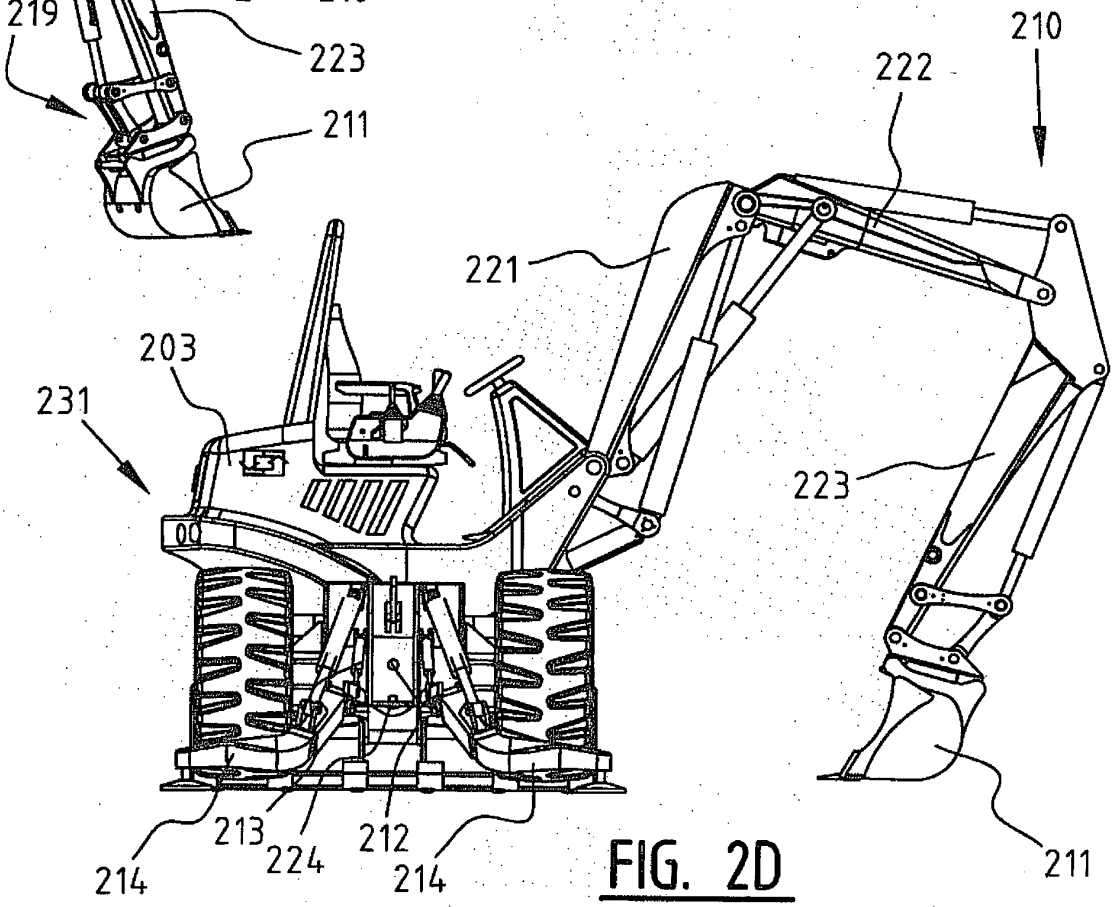

210
222
221
203
231
223
213
224
212
214
214
211

FIG. 2D

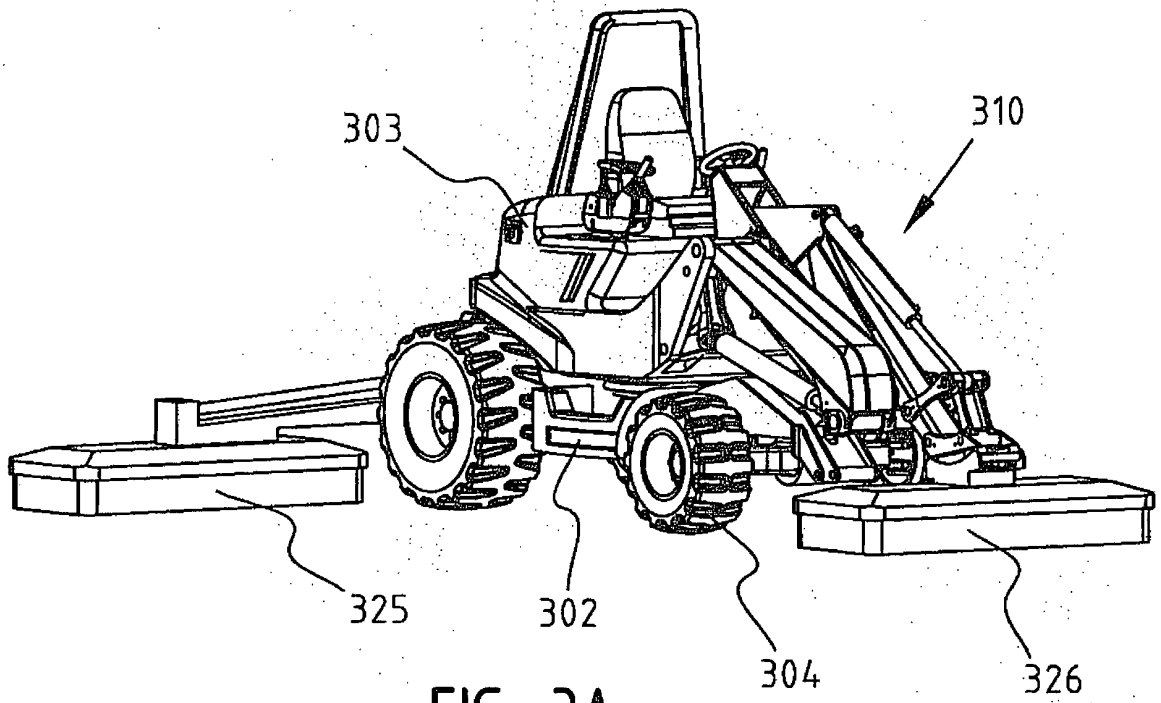


FIG. 3A

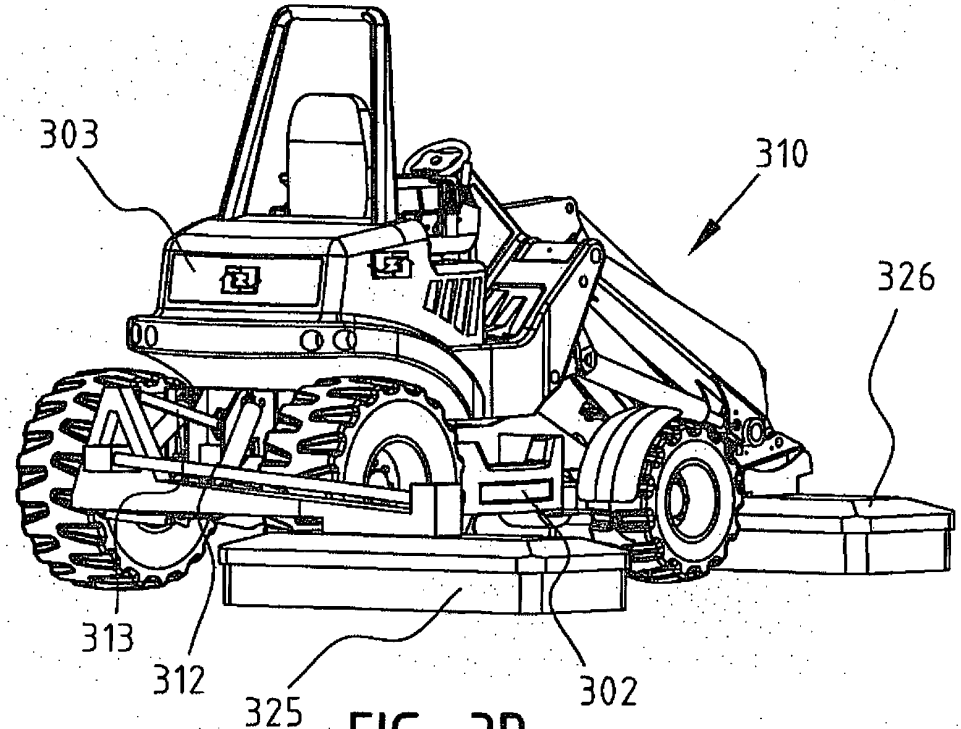


FIG. 3B

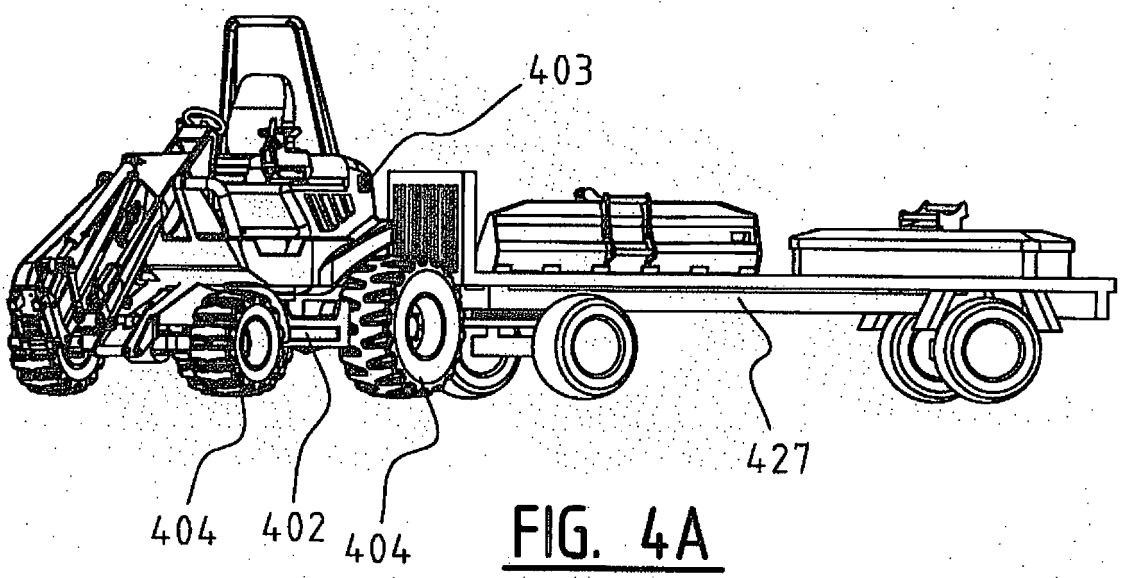


FIG. 4A

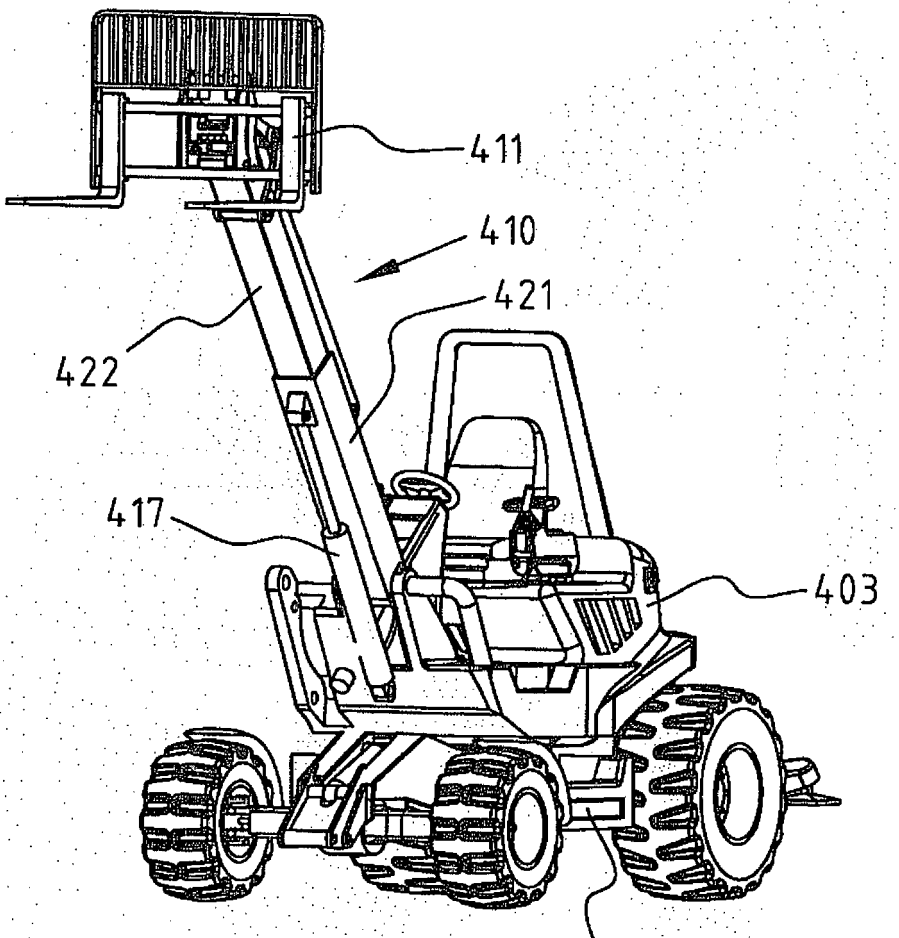


FIG. 4B

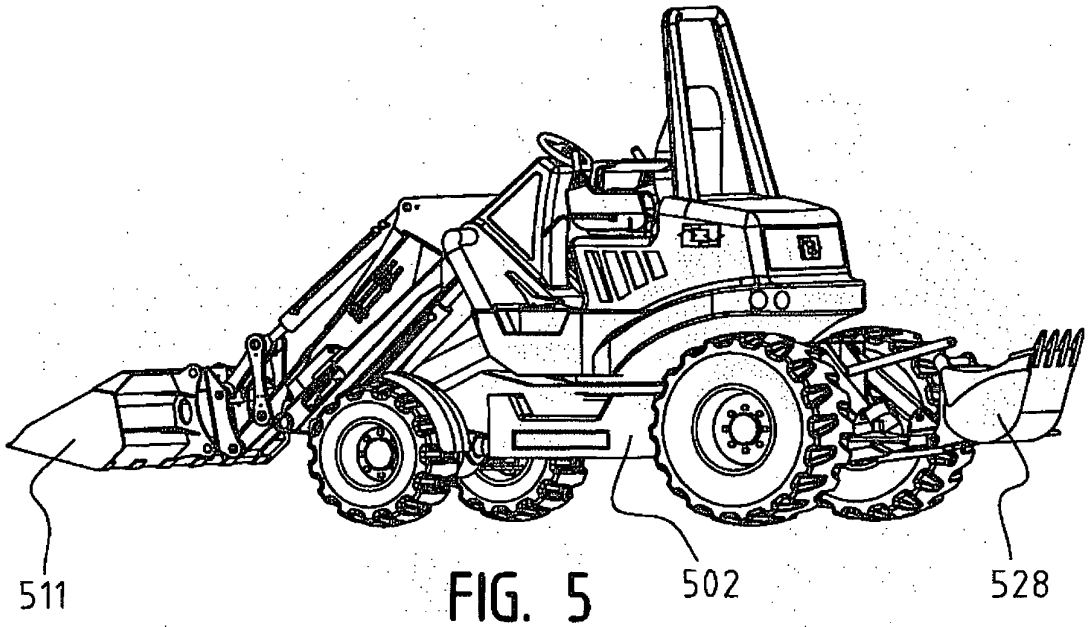


FIG. 5

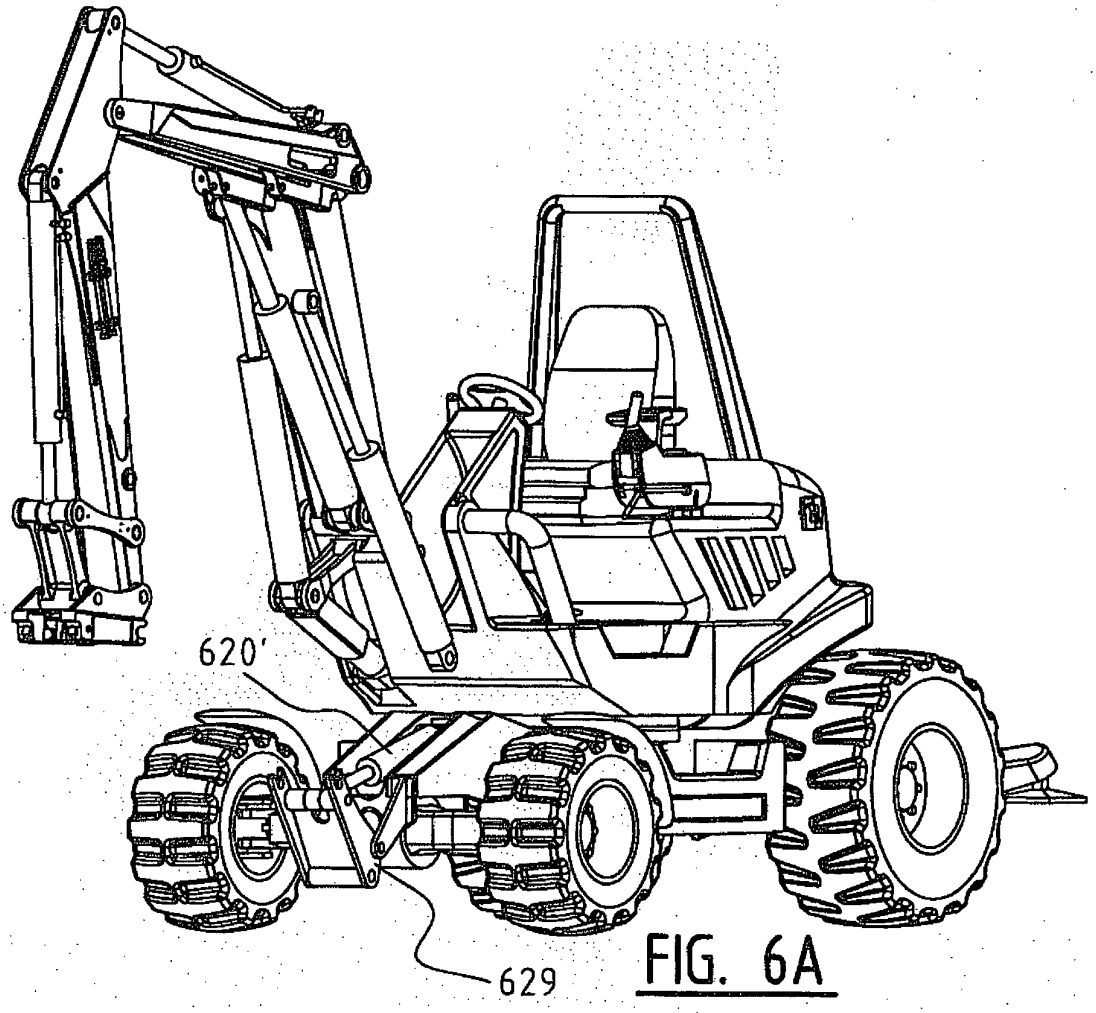


FIG. 6A

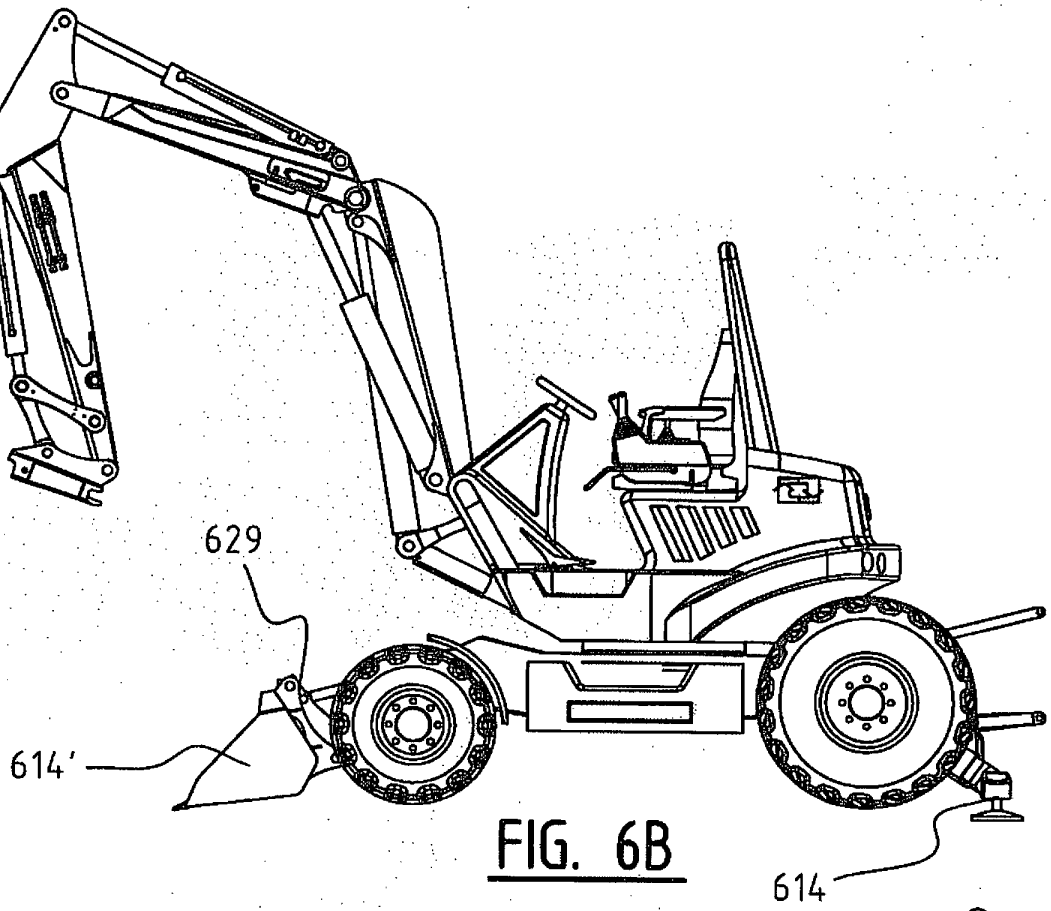


FIG. 6B

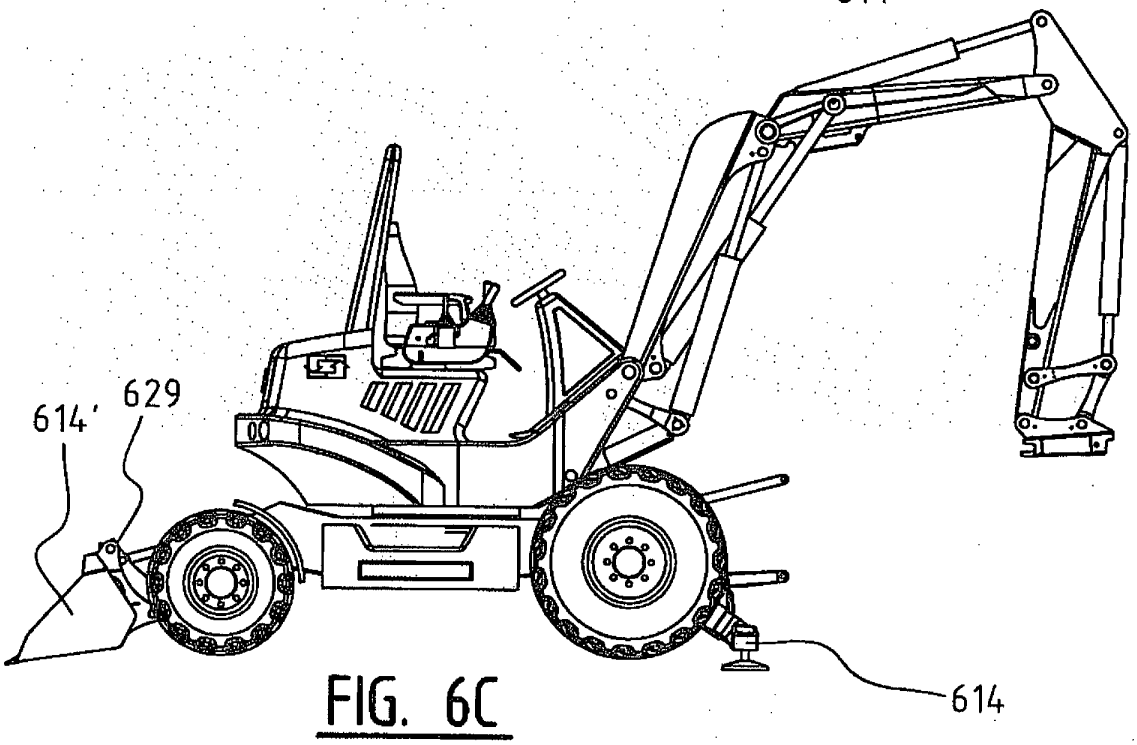


FIG. 6C

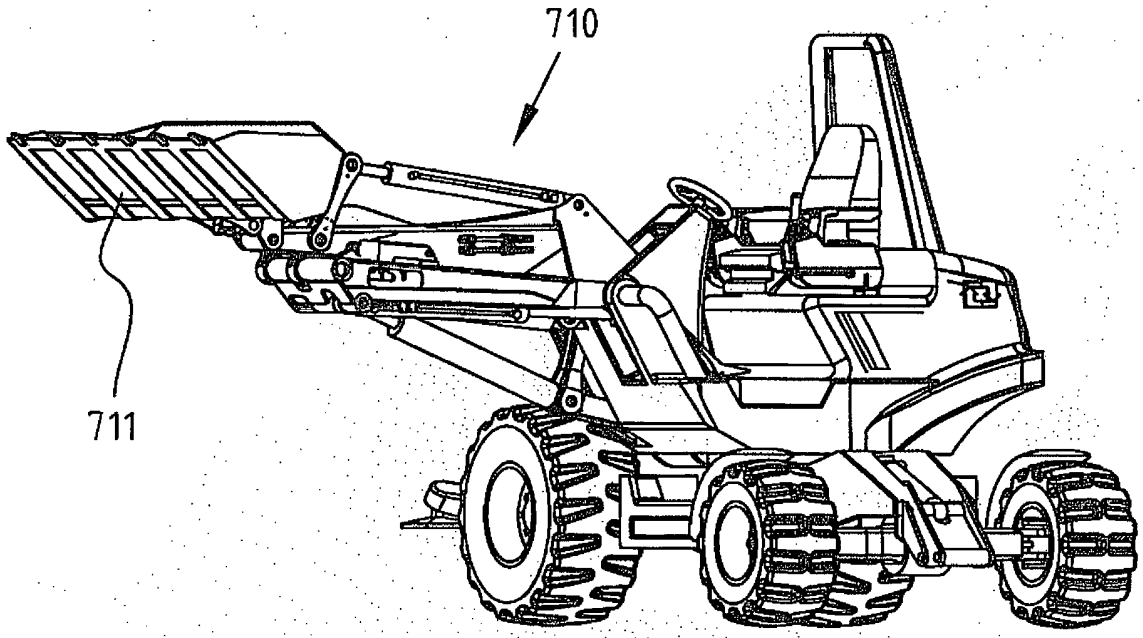


FIG. 7

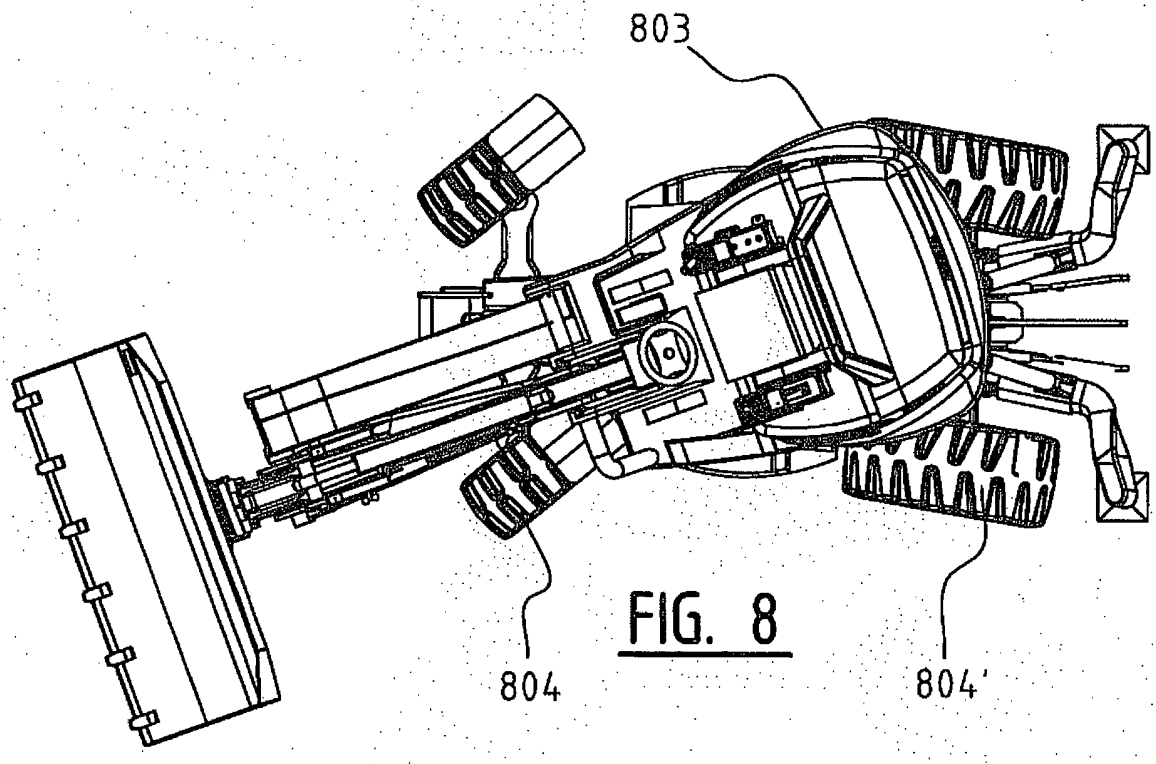


FIG. 8

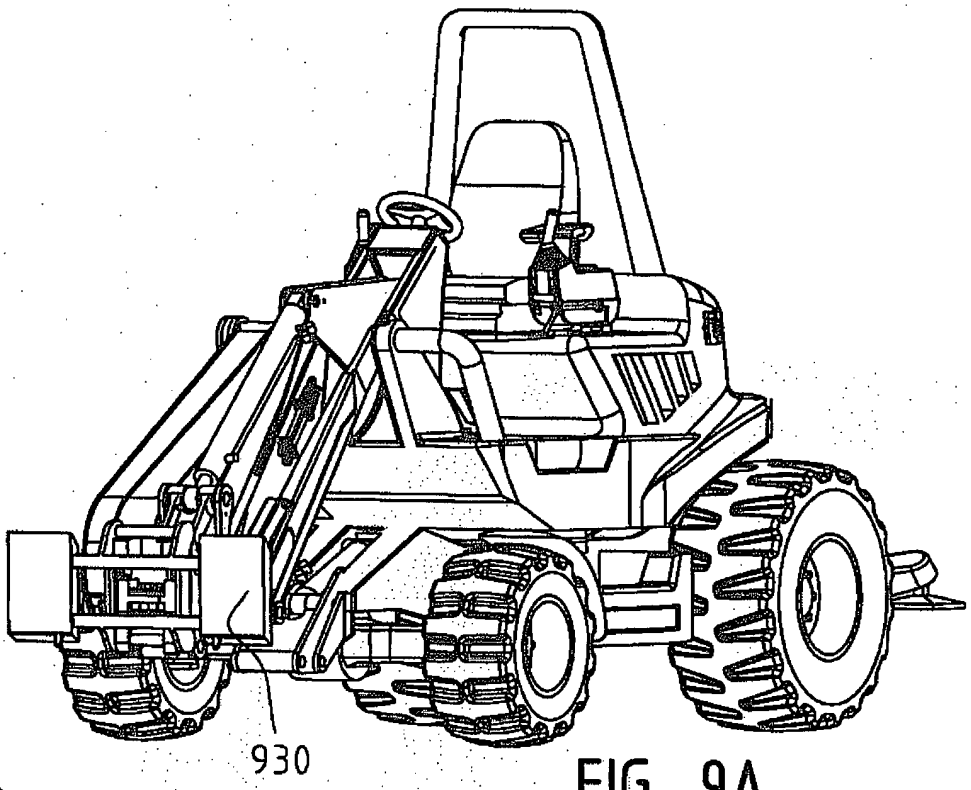


FIG. 9A

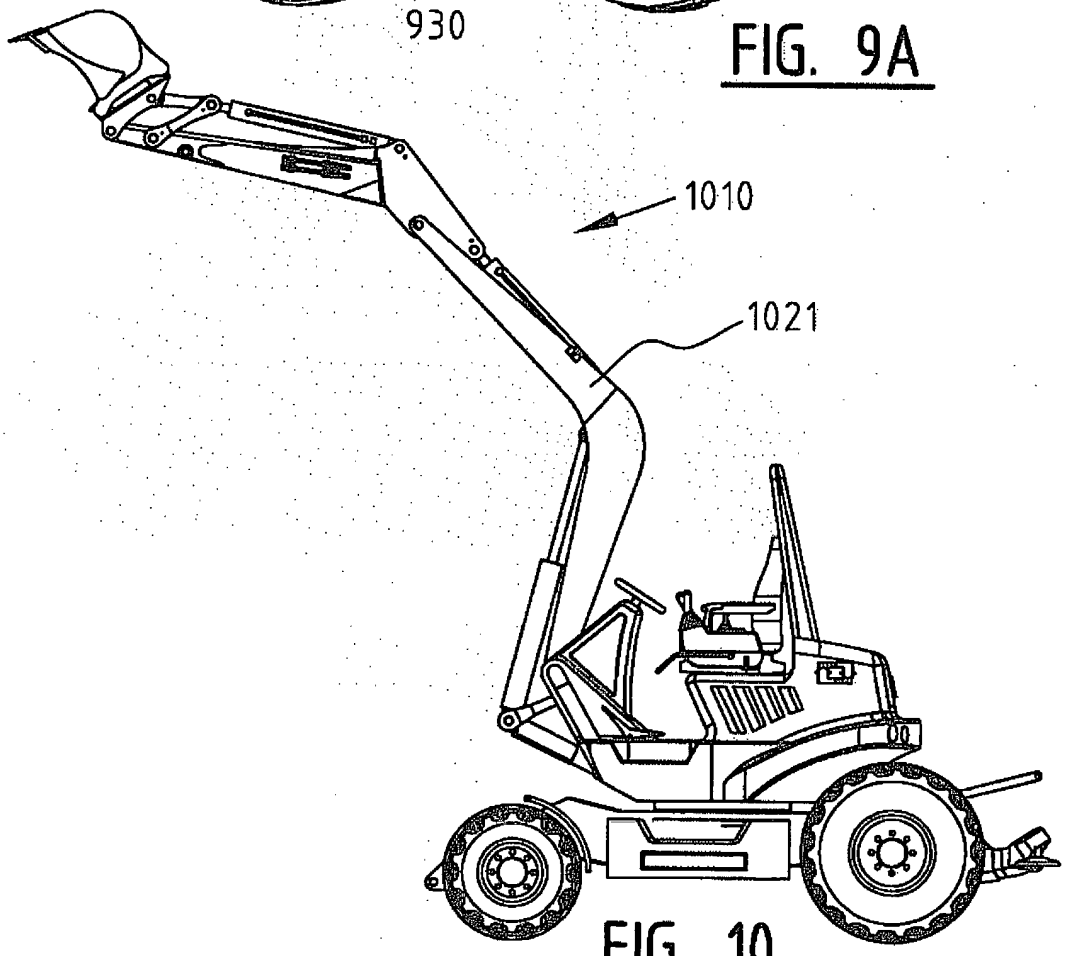


FIG. 10

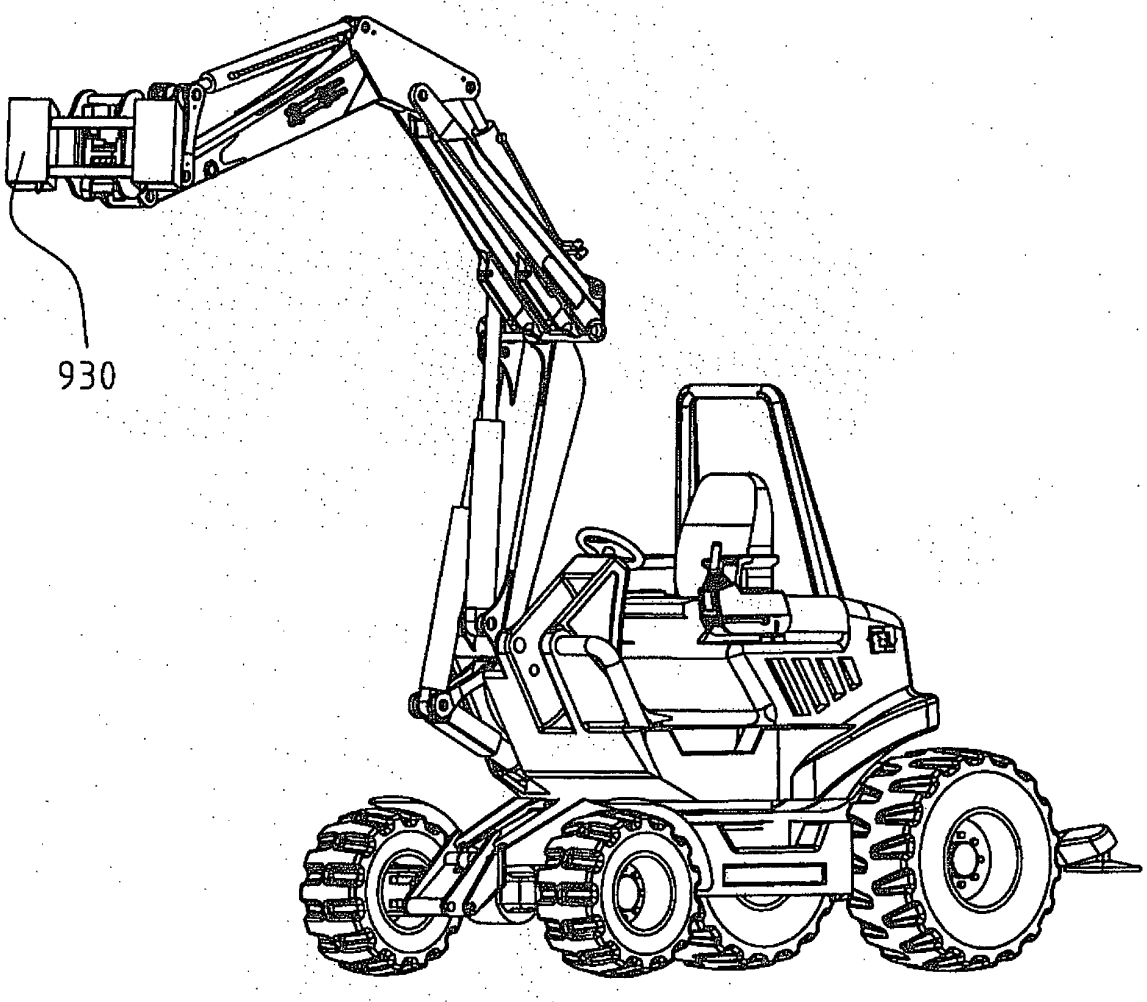


FIG. 9B

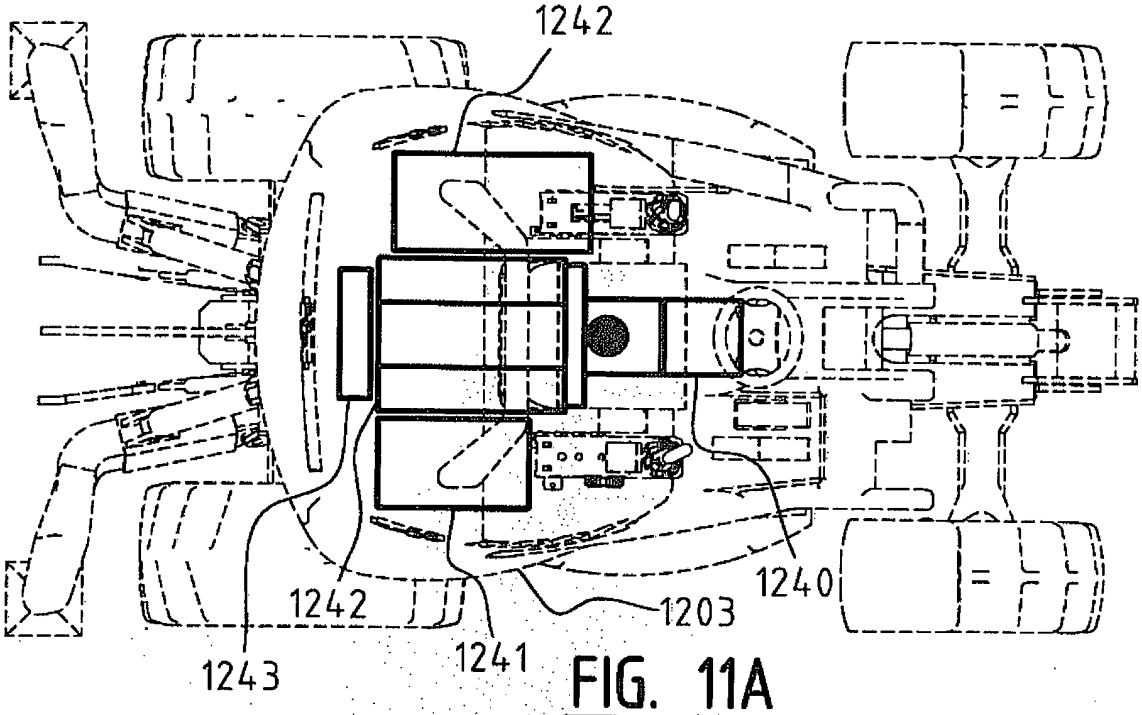


FIG. 11A

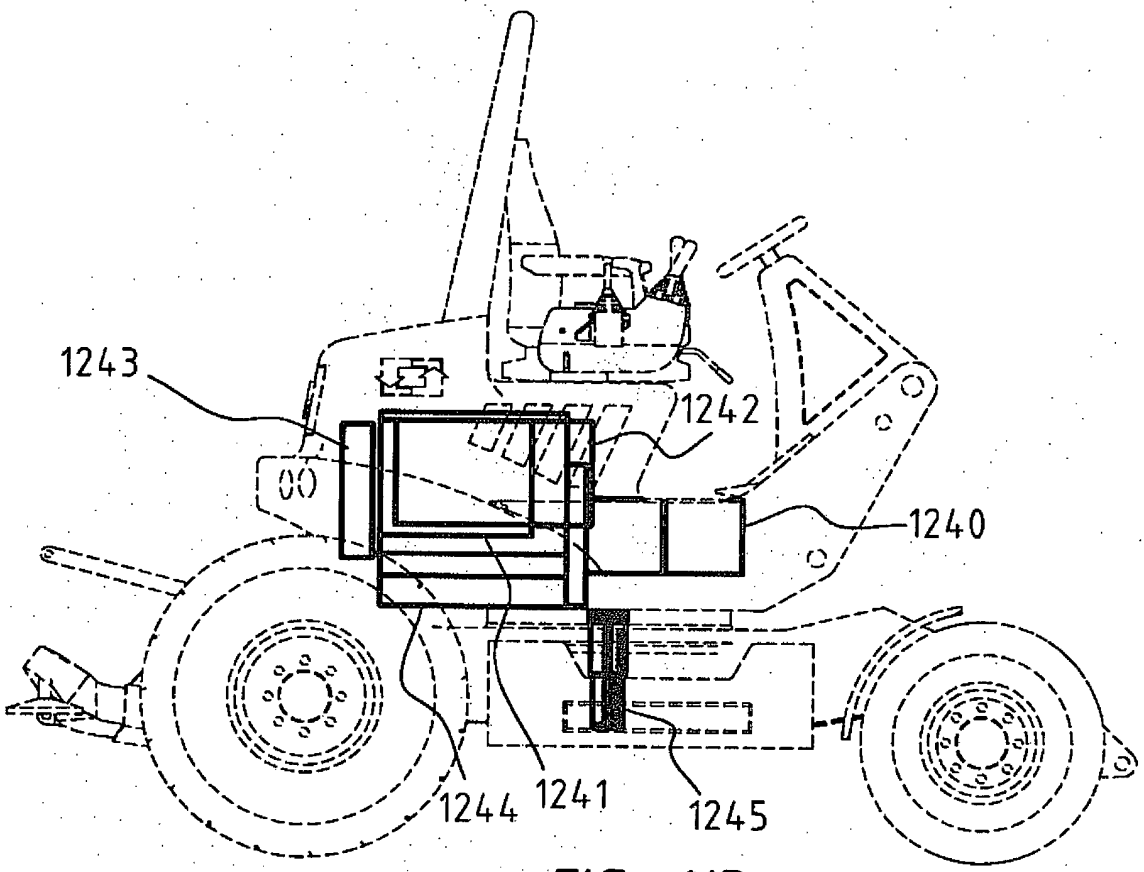


FIG. 11B

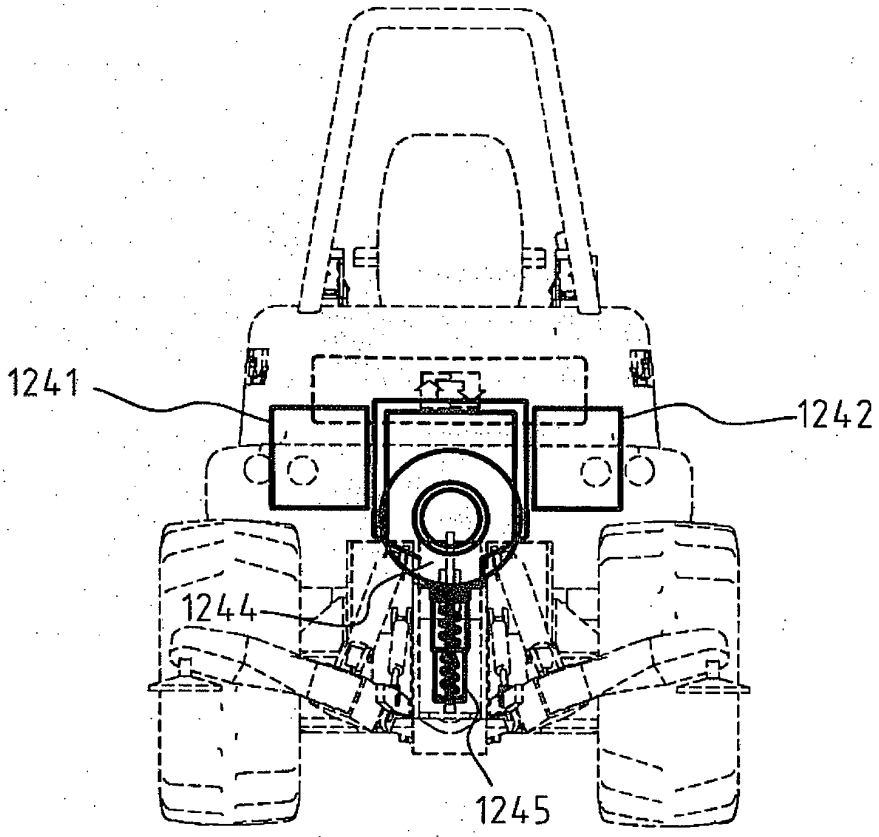


FIG. 11C

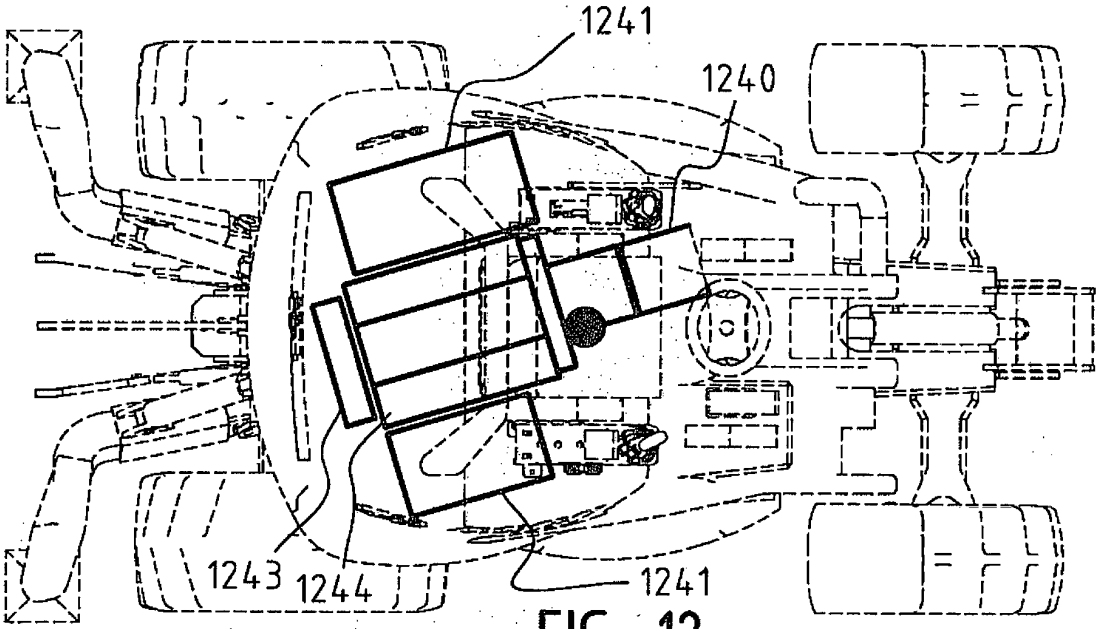


FIG. 12

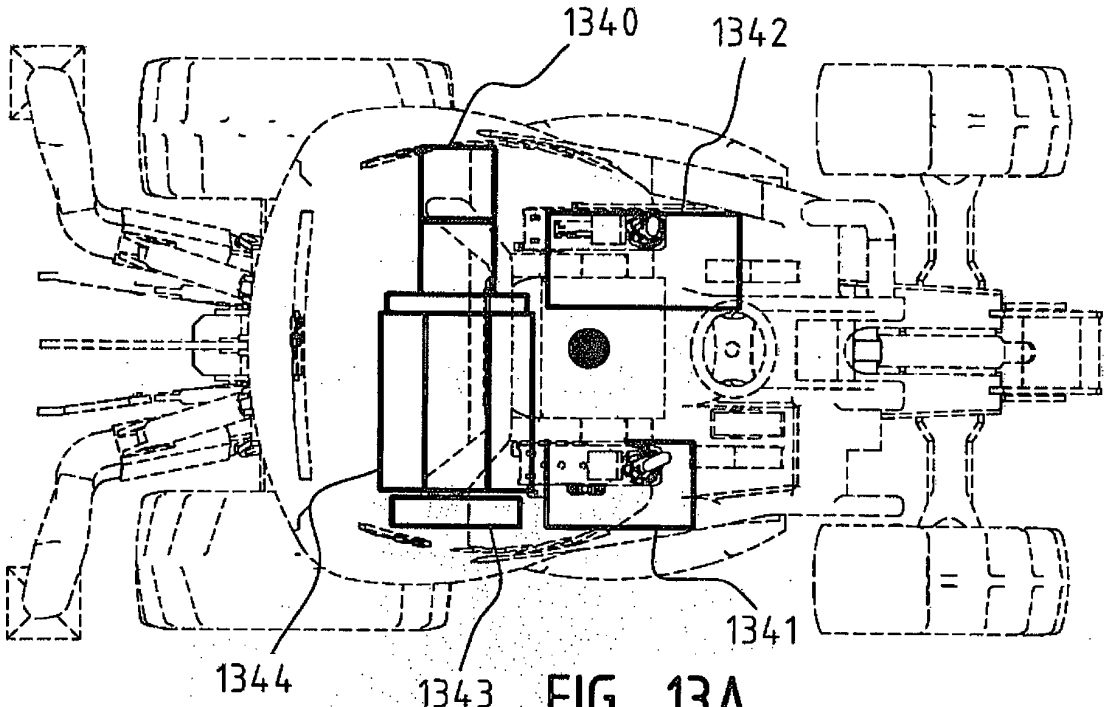


FIG. 13A

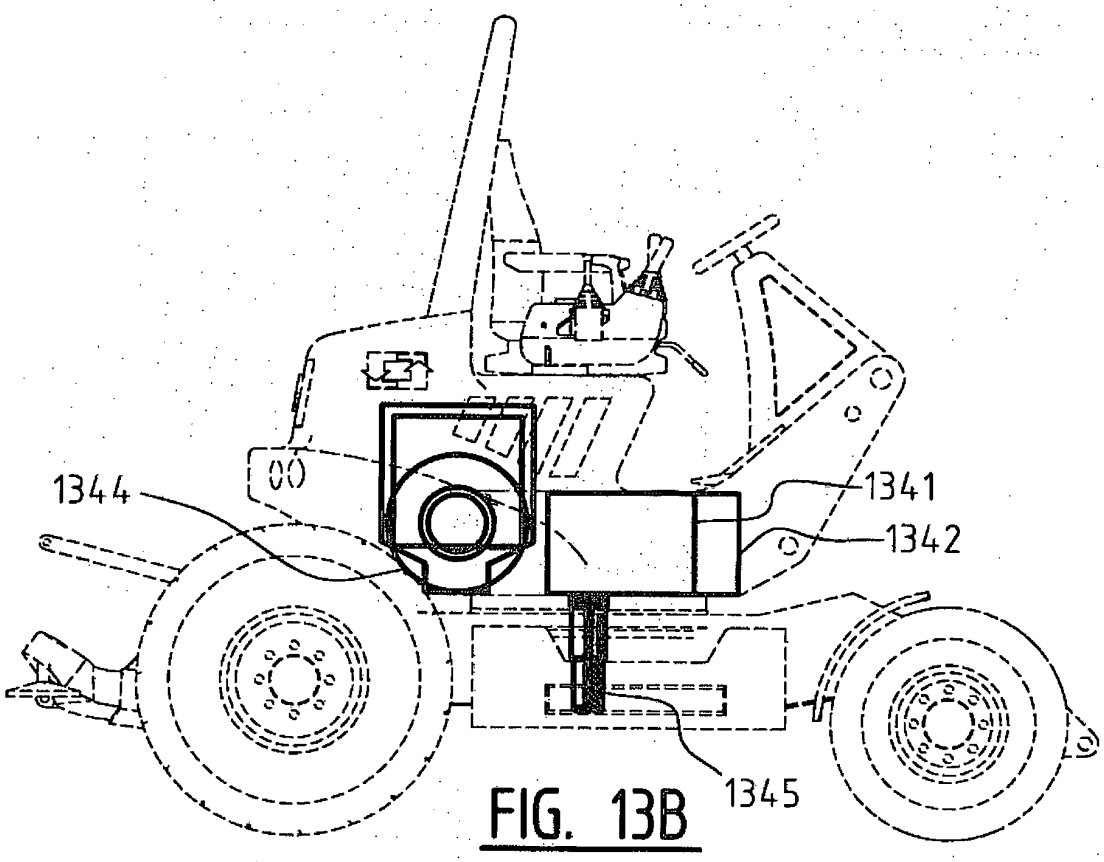


FIG. 13B

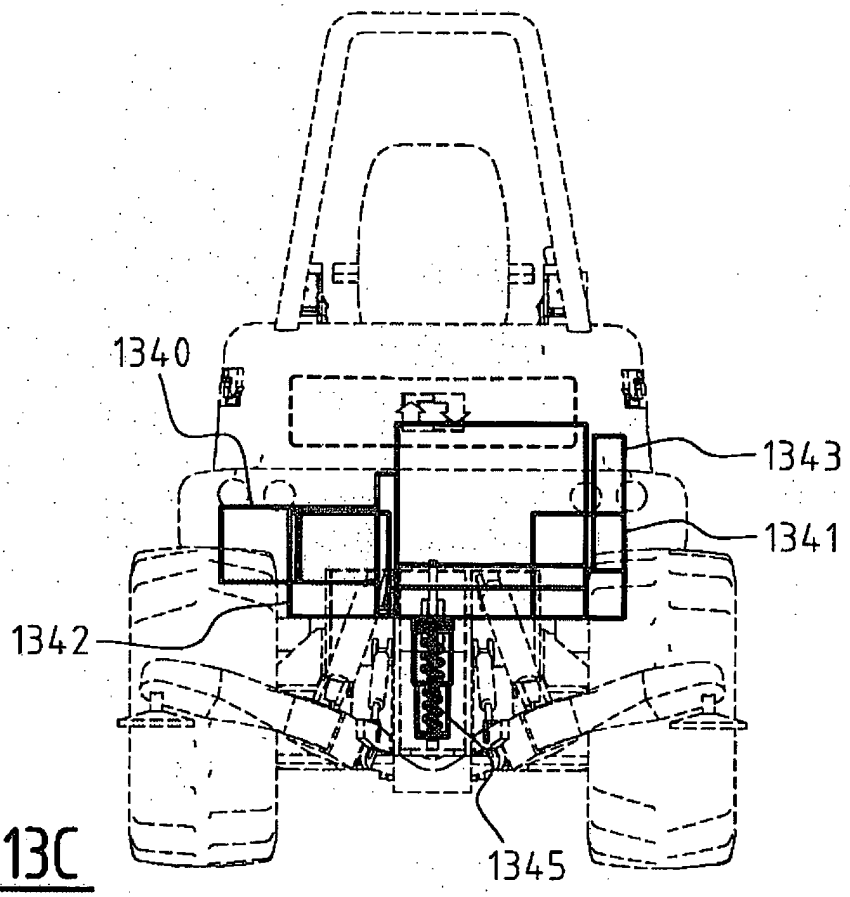


FIG. 13C

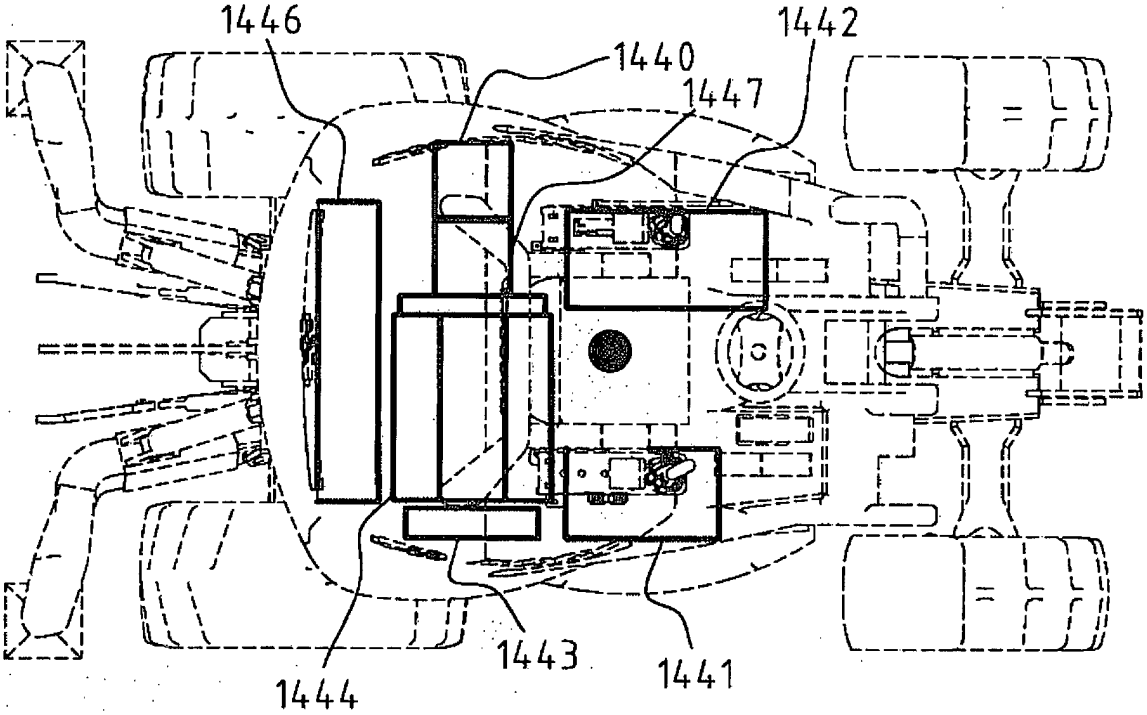


FIG. 14A

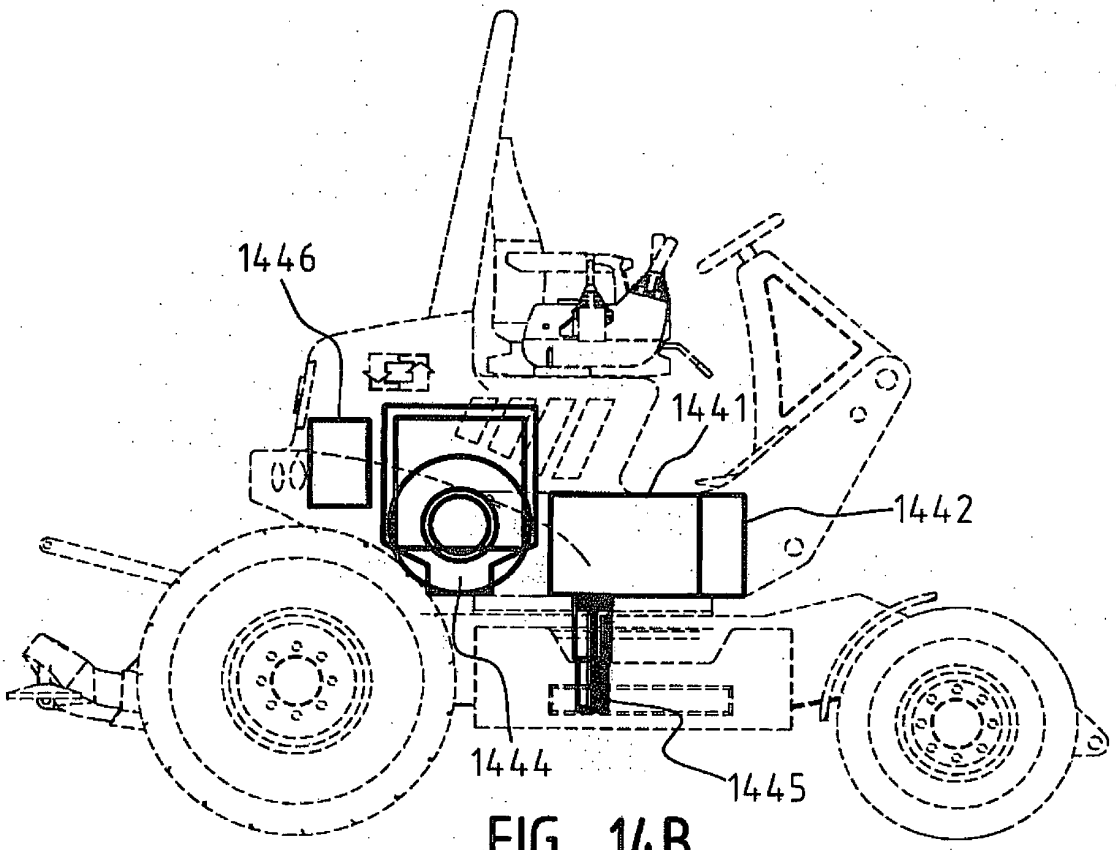


FIG. 14B

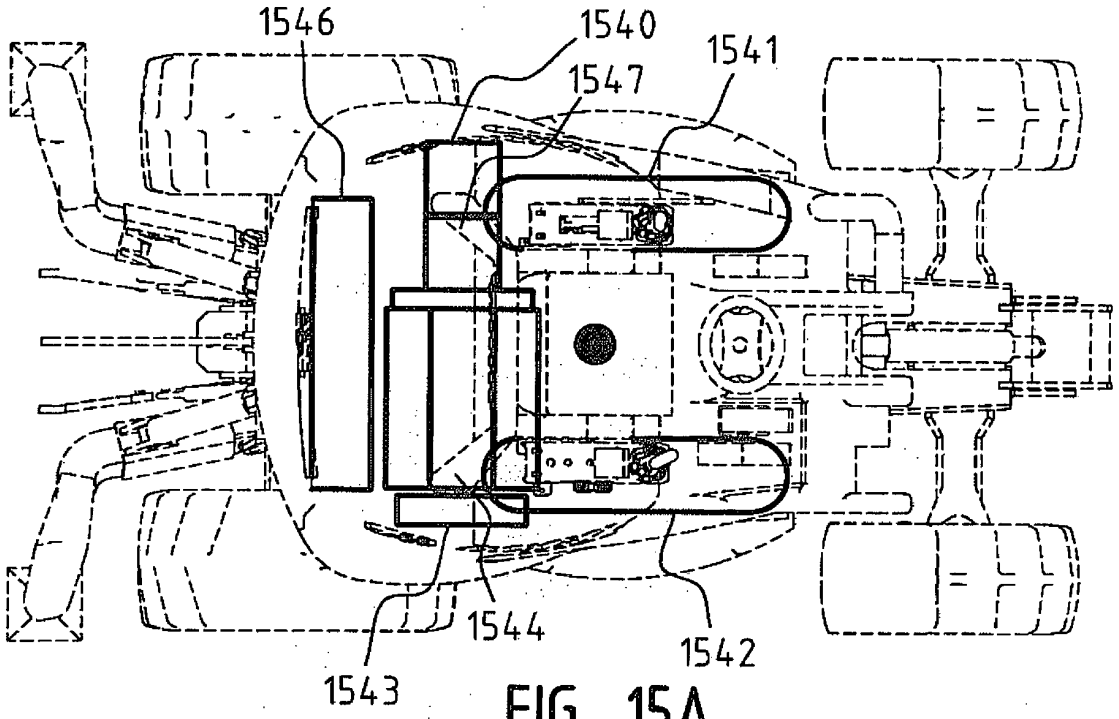


FIG. 15A

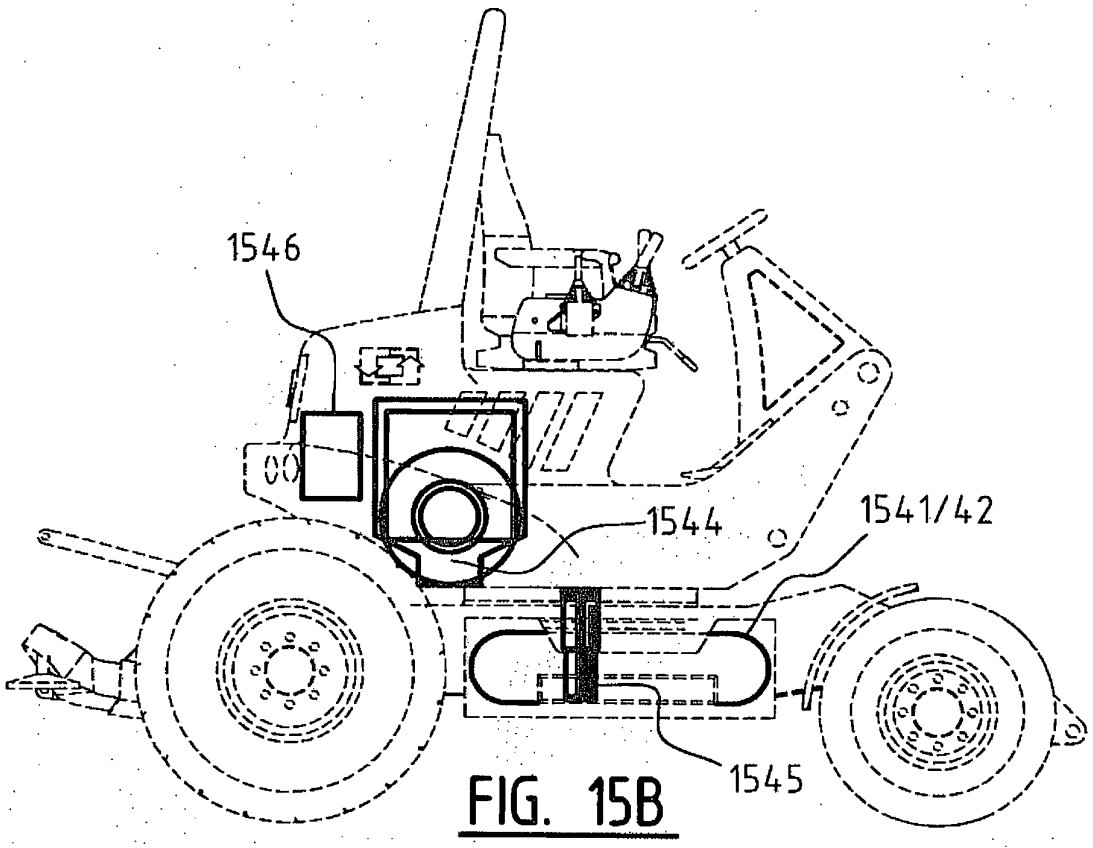


FIG. 15B

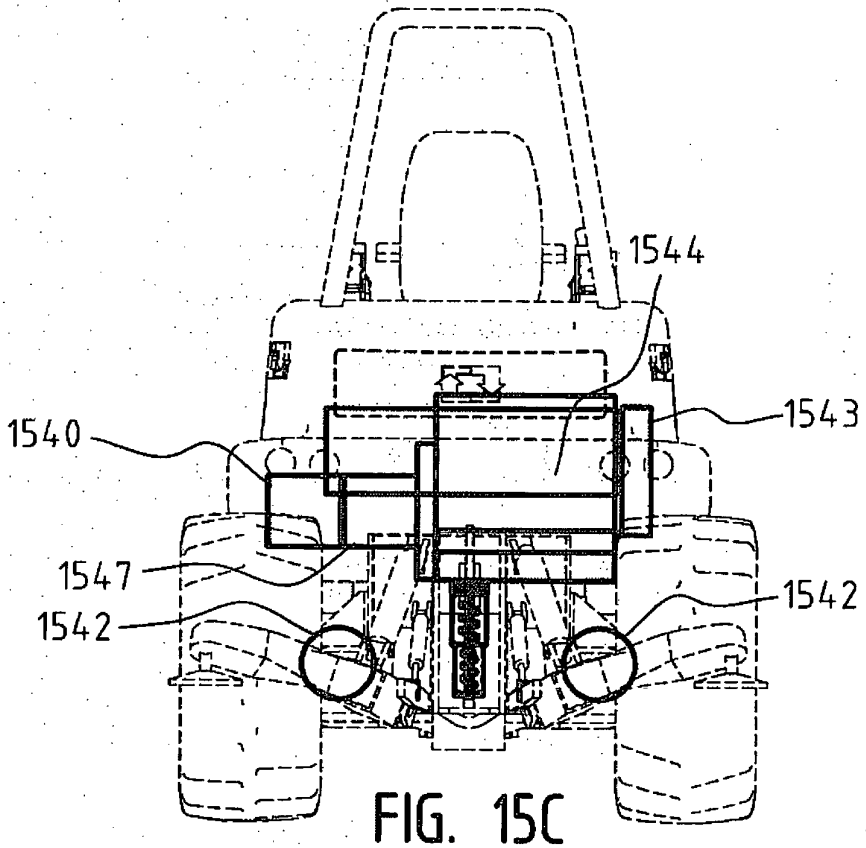


FIG. 15C

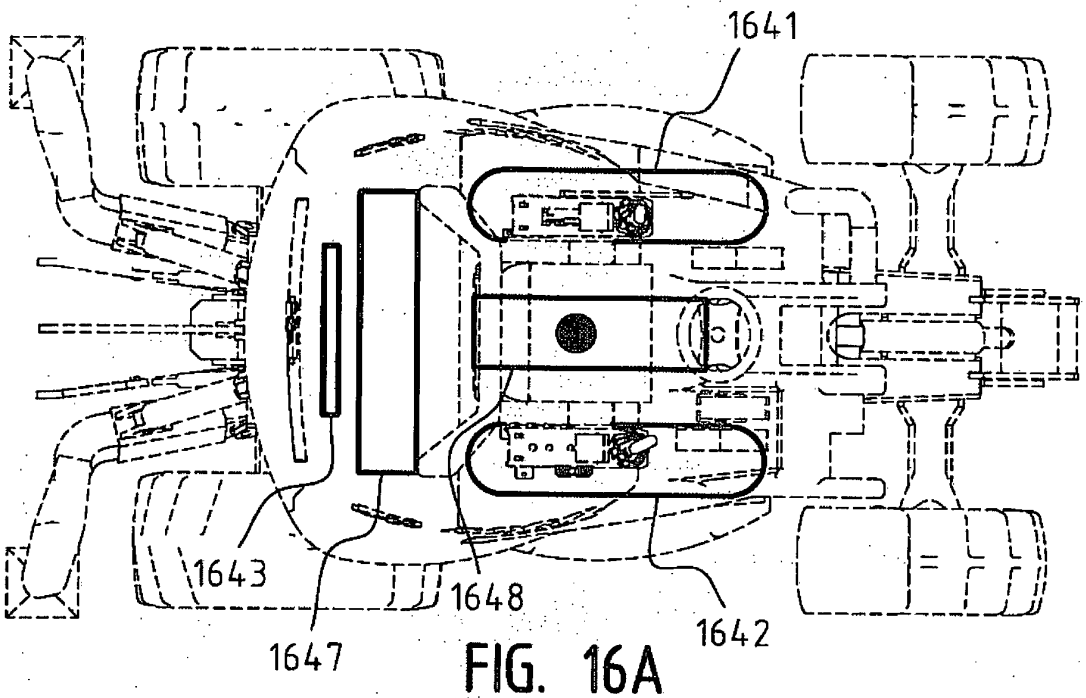


FIG. 16A

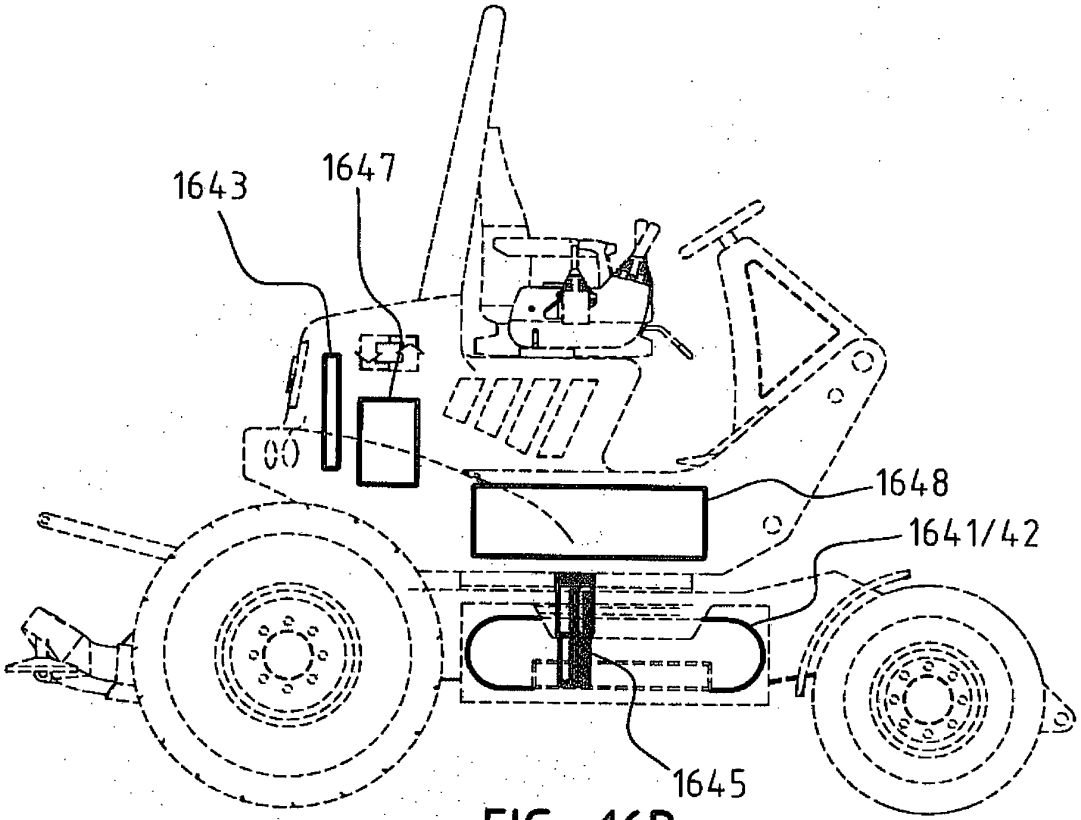


FIG. 16B

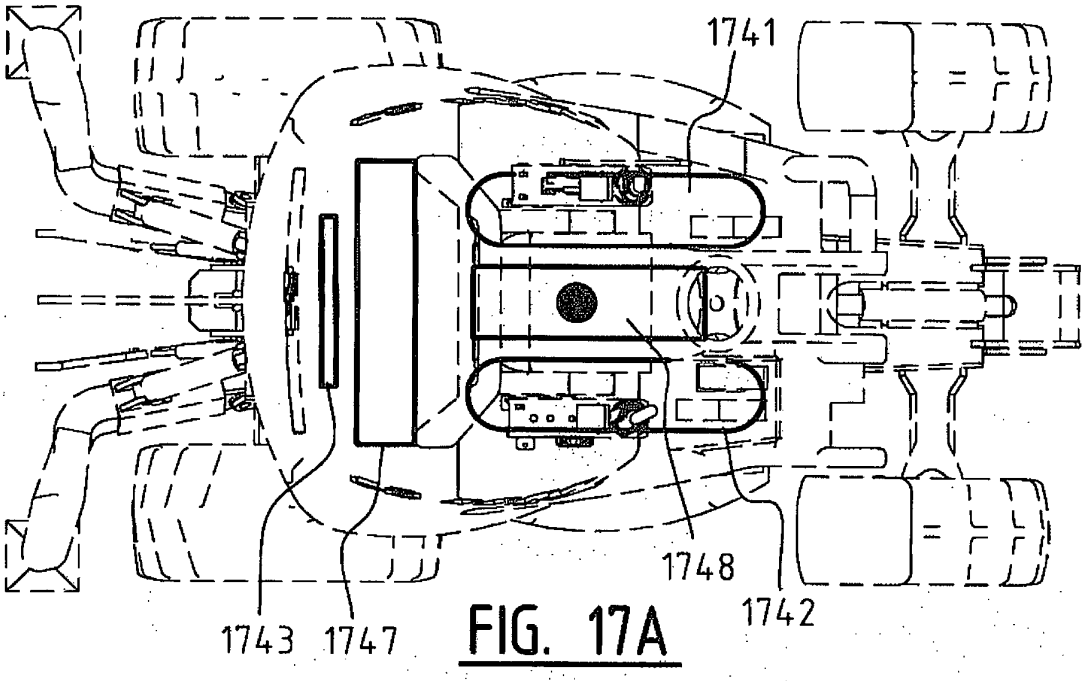


FIG. 17A

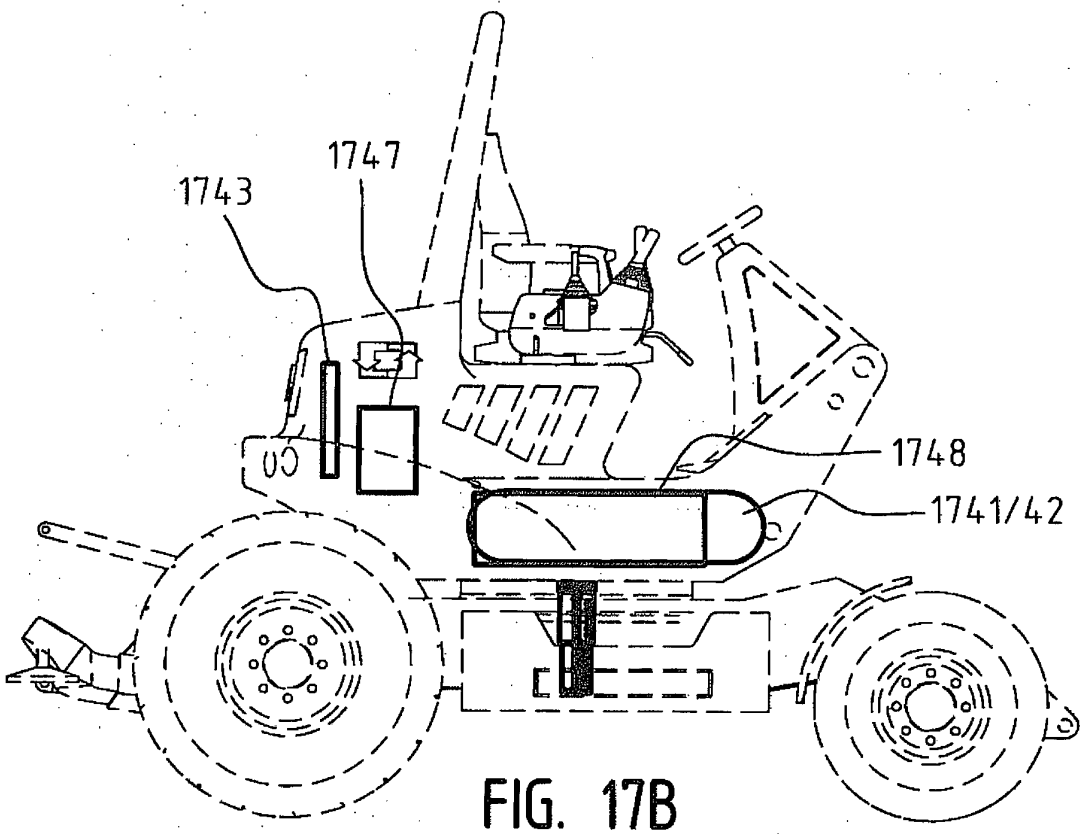


FIG. 17B

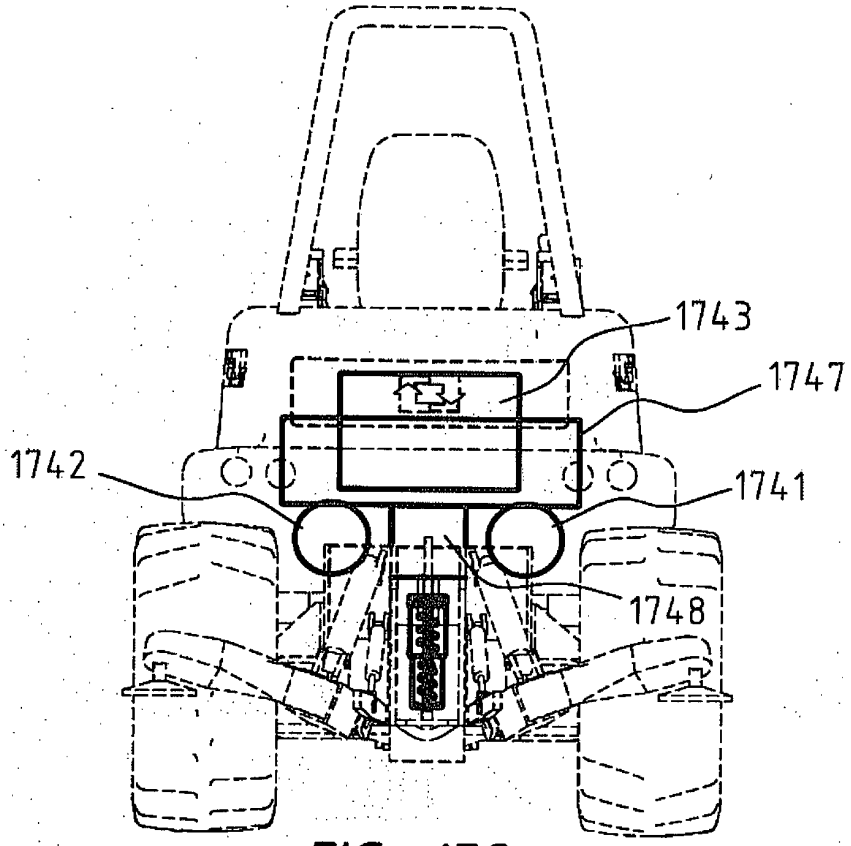


FIG. 17C

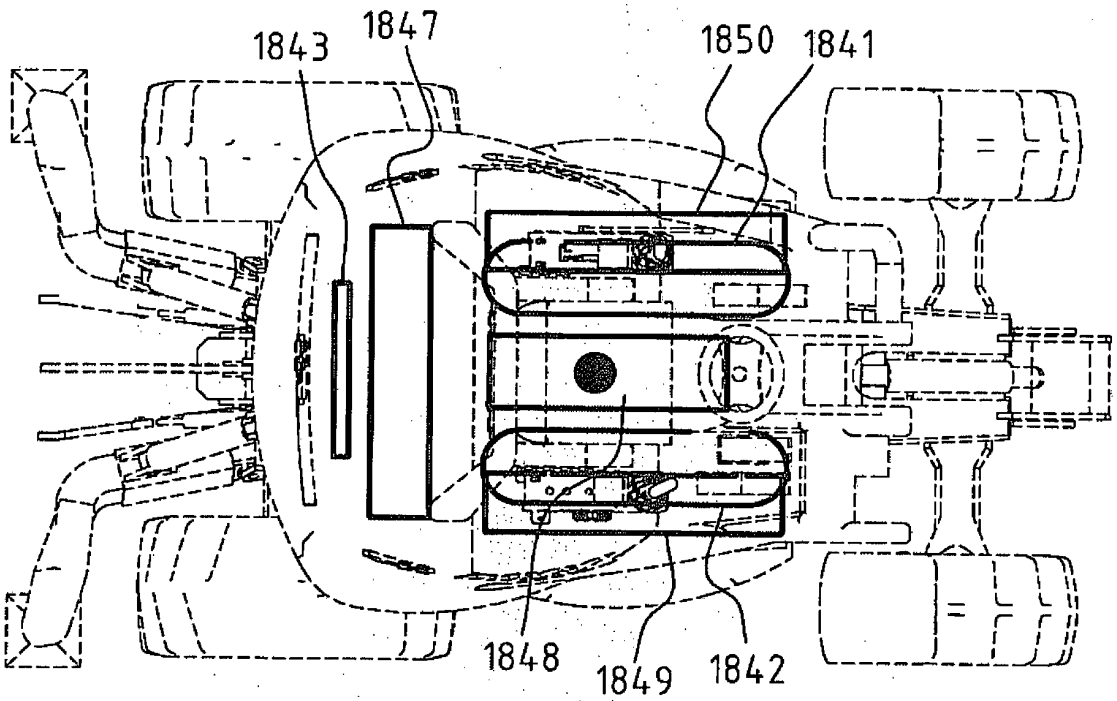


FIG. 18A

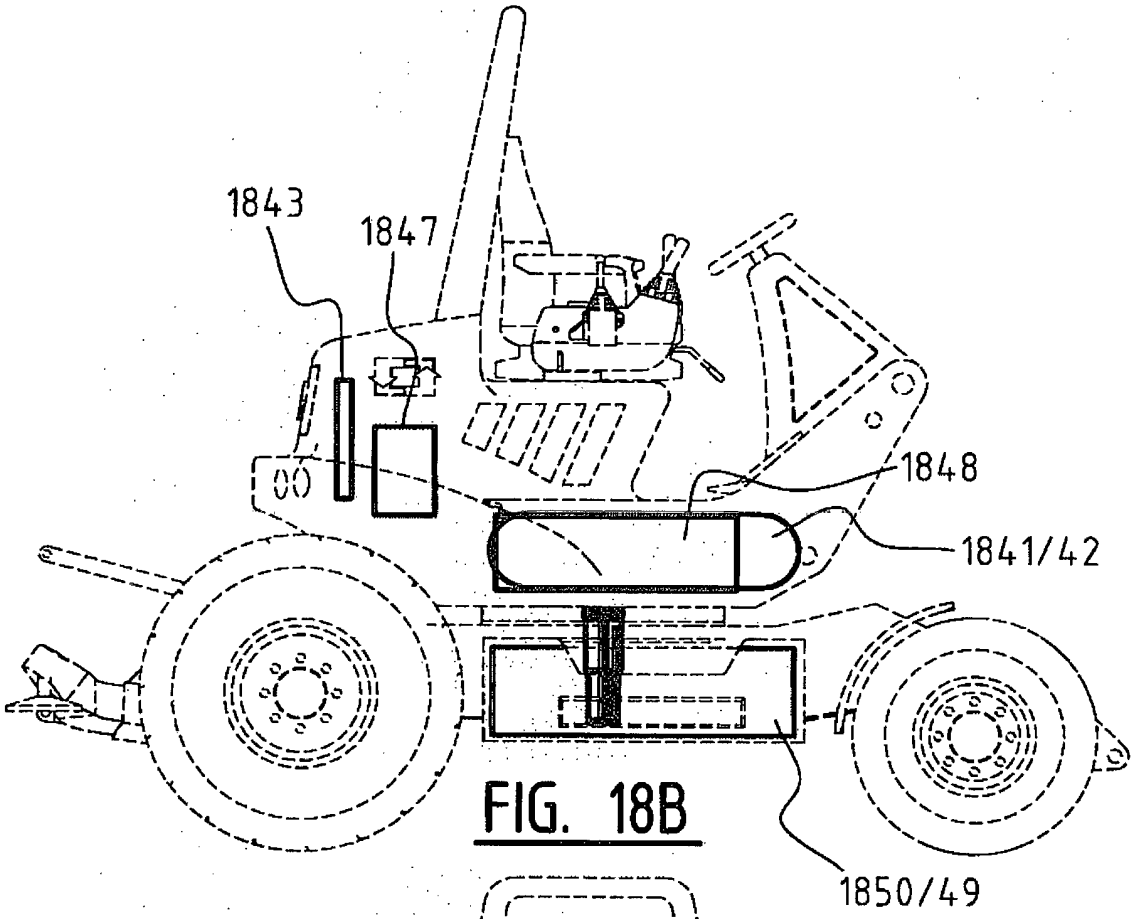


FIG. 18B

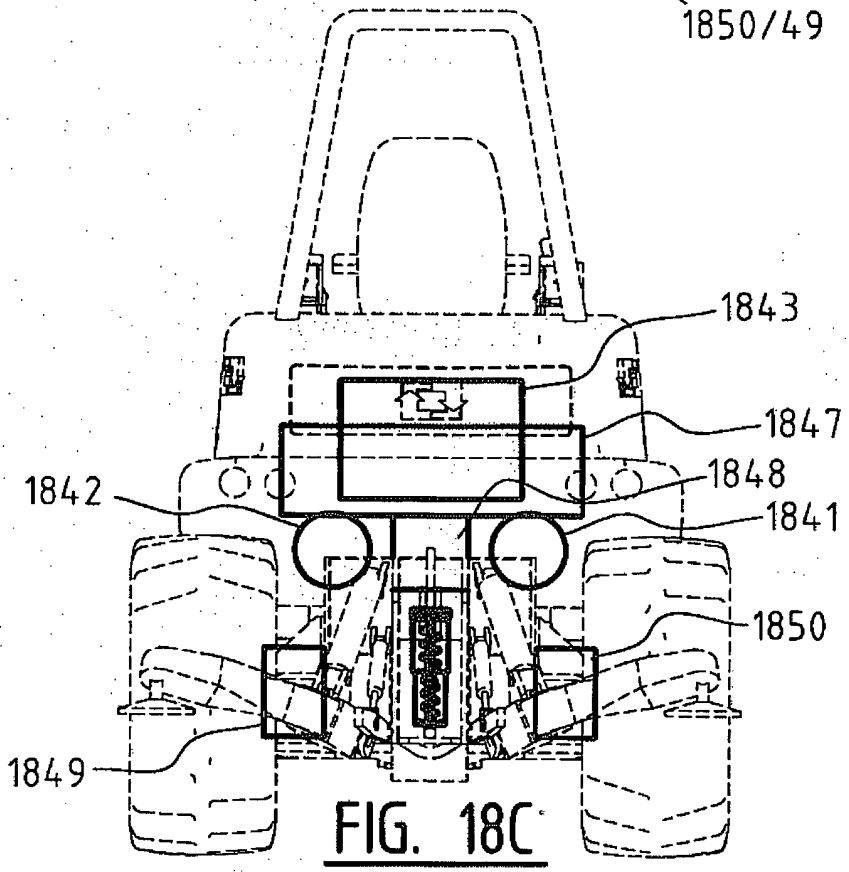


FIG. 18C

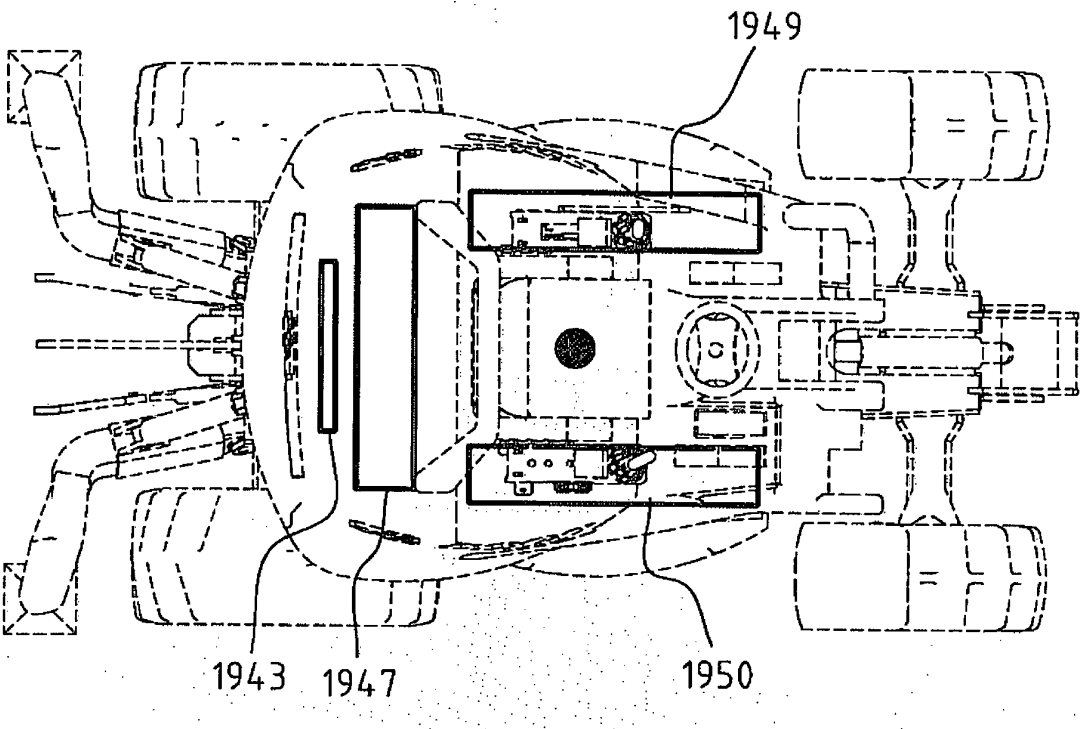


FIG. 19A

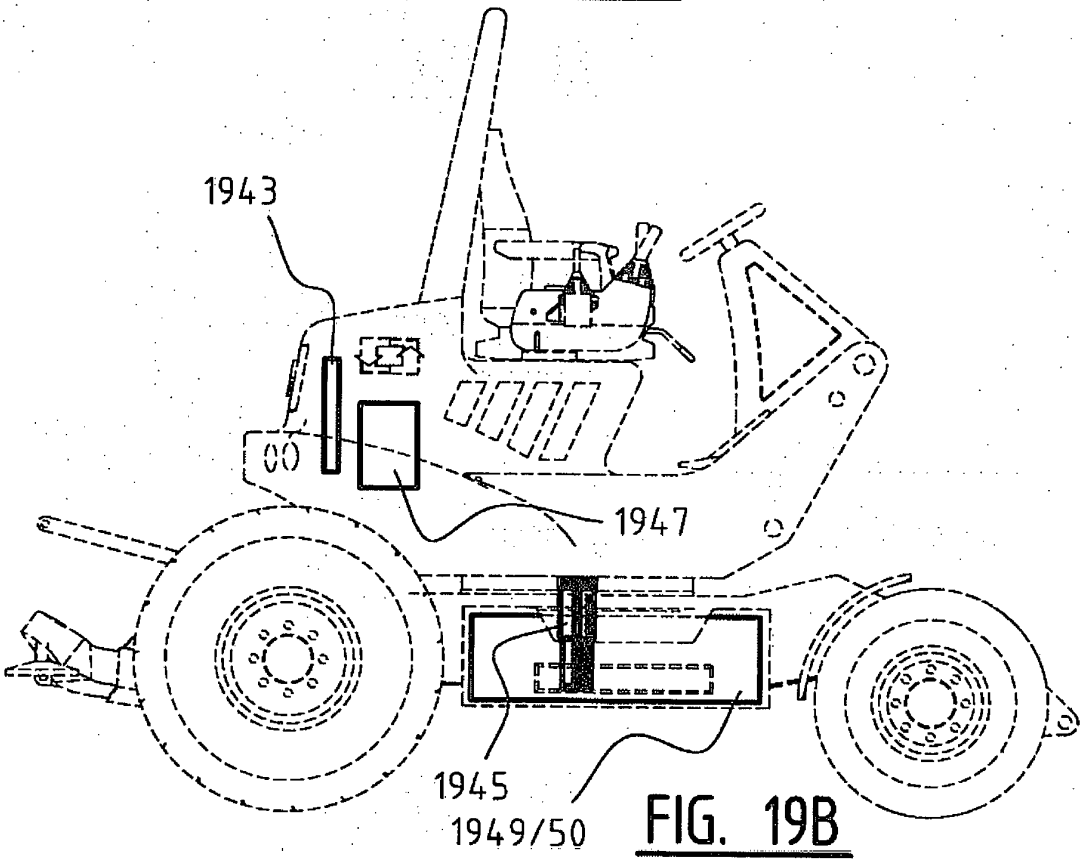


FIG. 19B

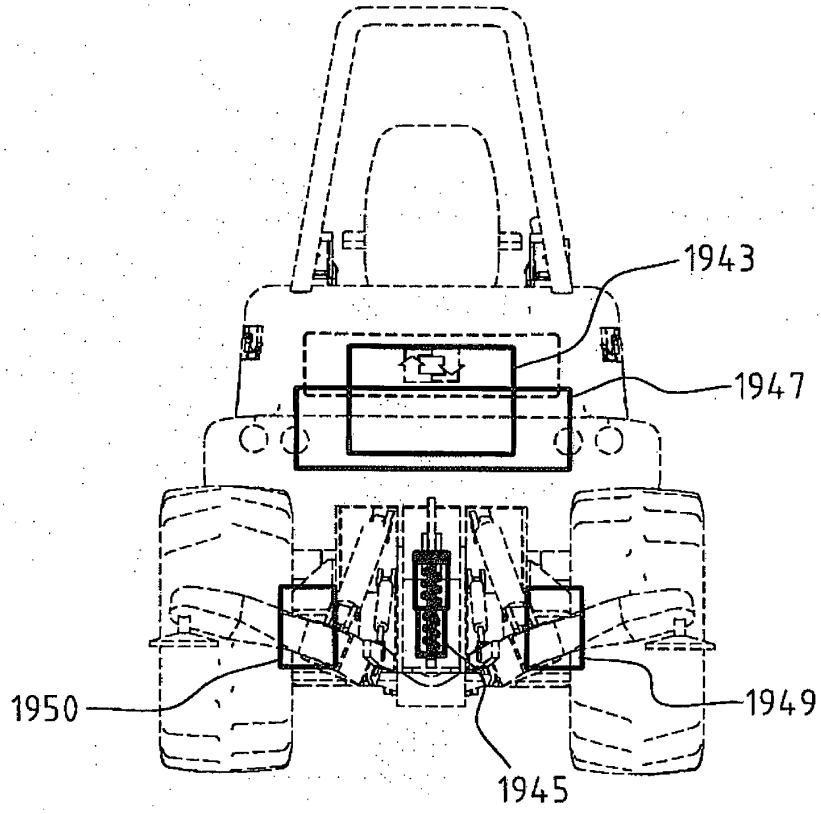


FIG. 19C

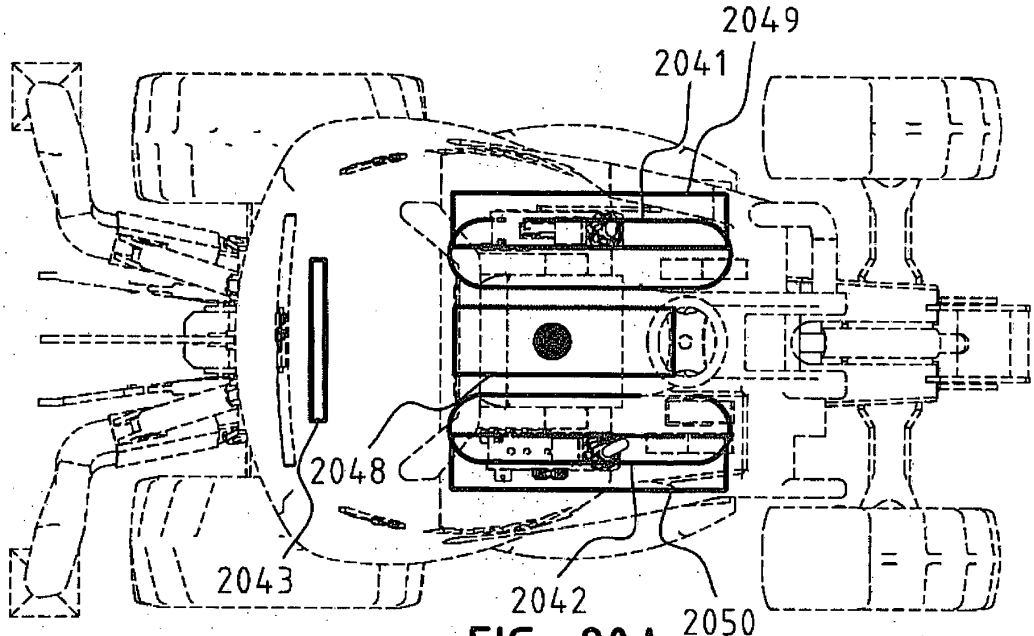


FIG. 20A

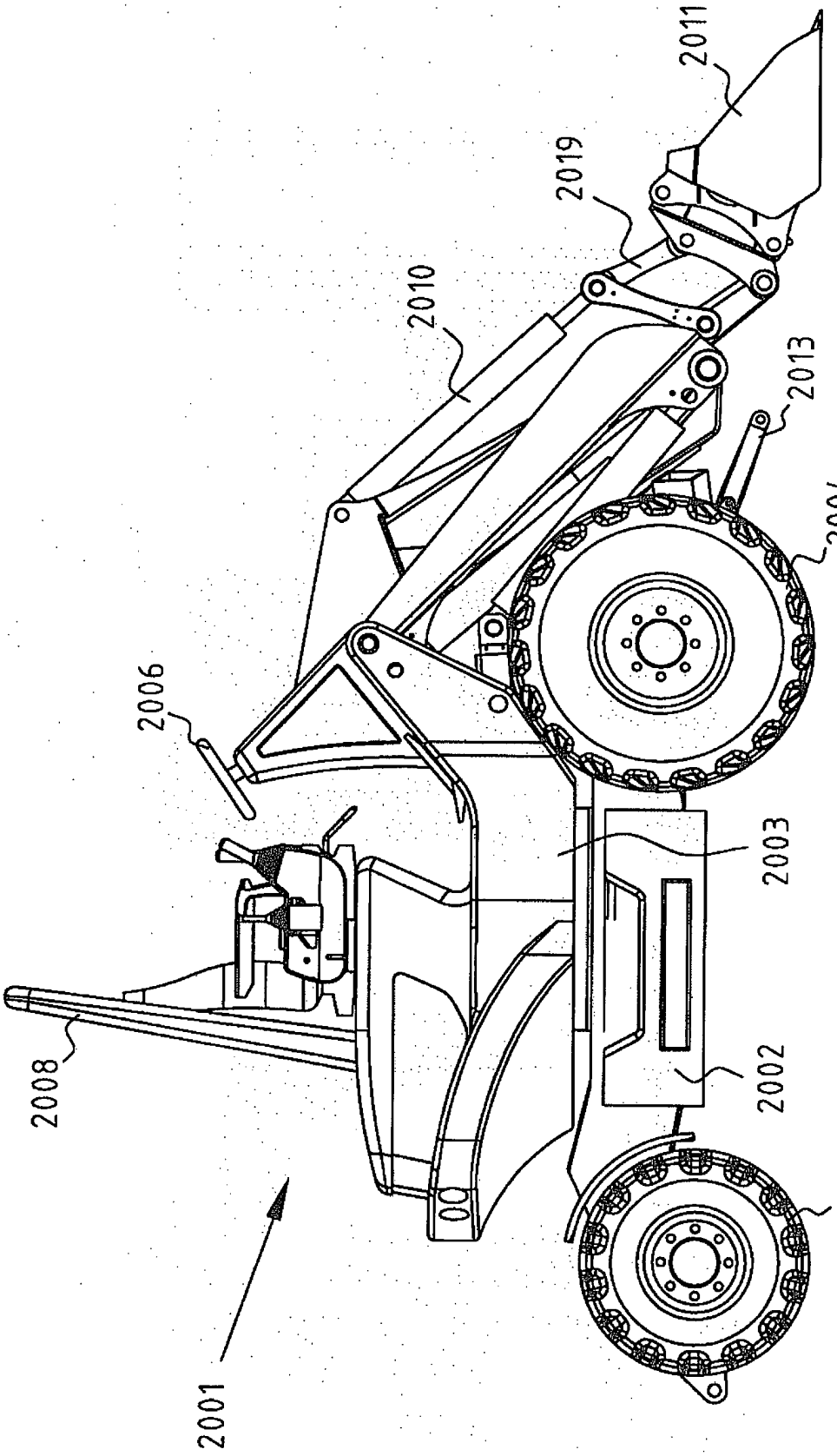


FIG. 21A

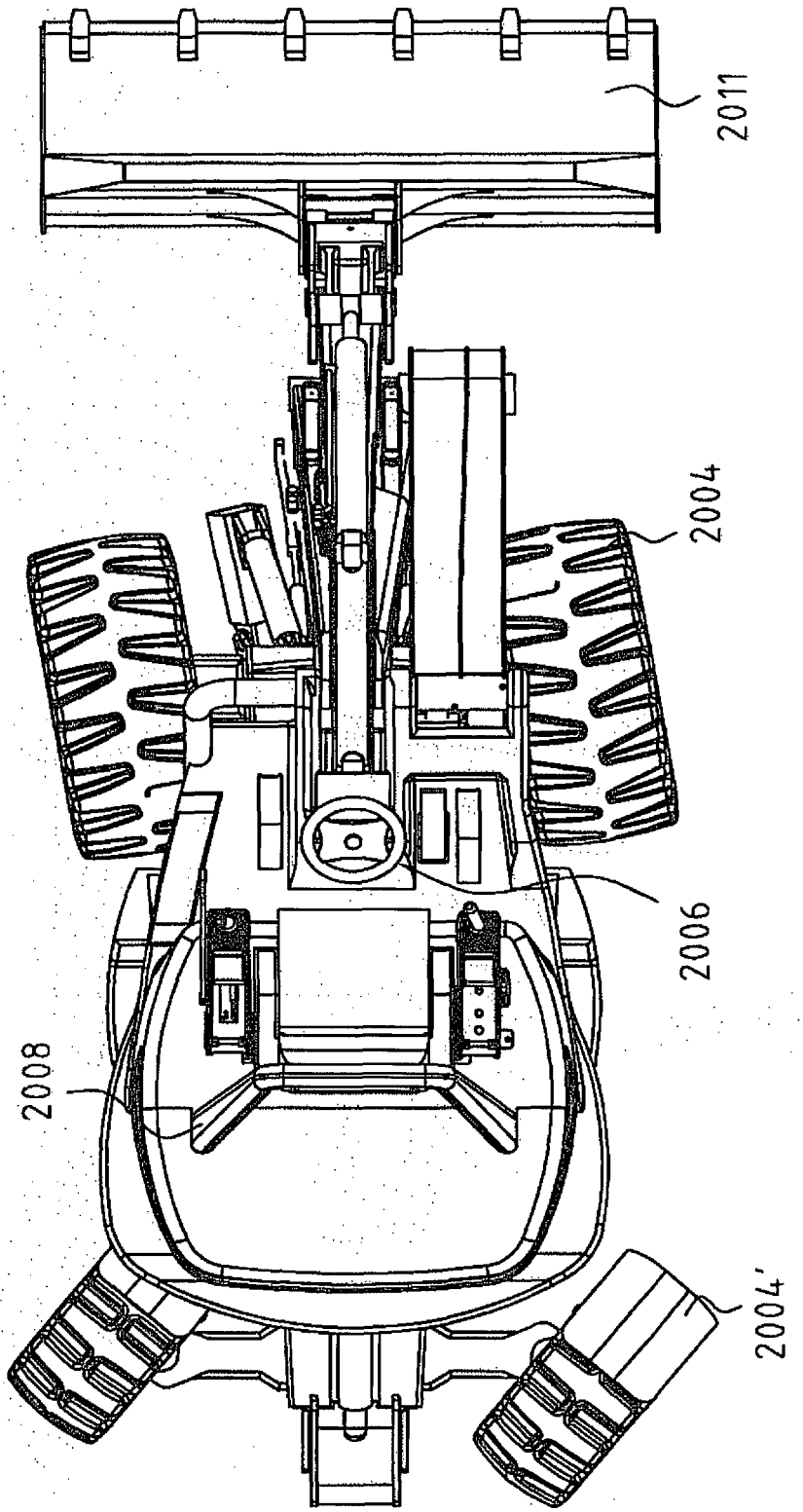


FIG. 21B

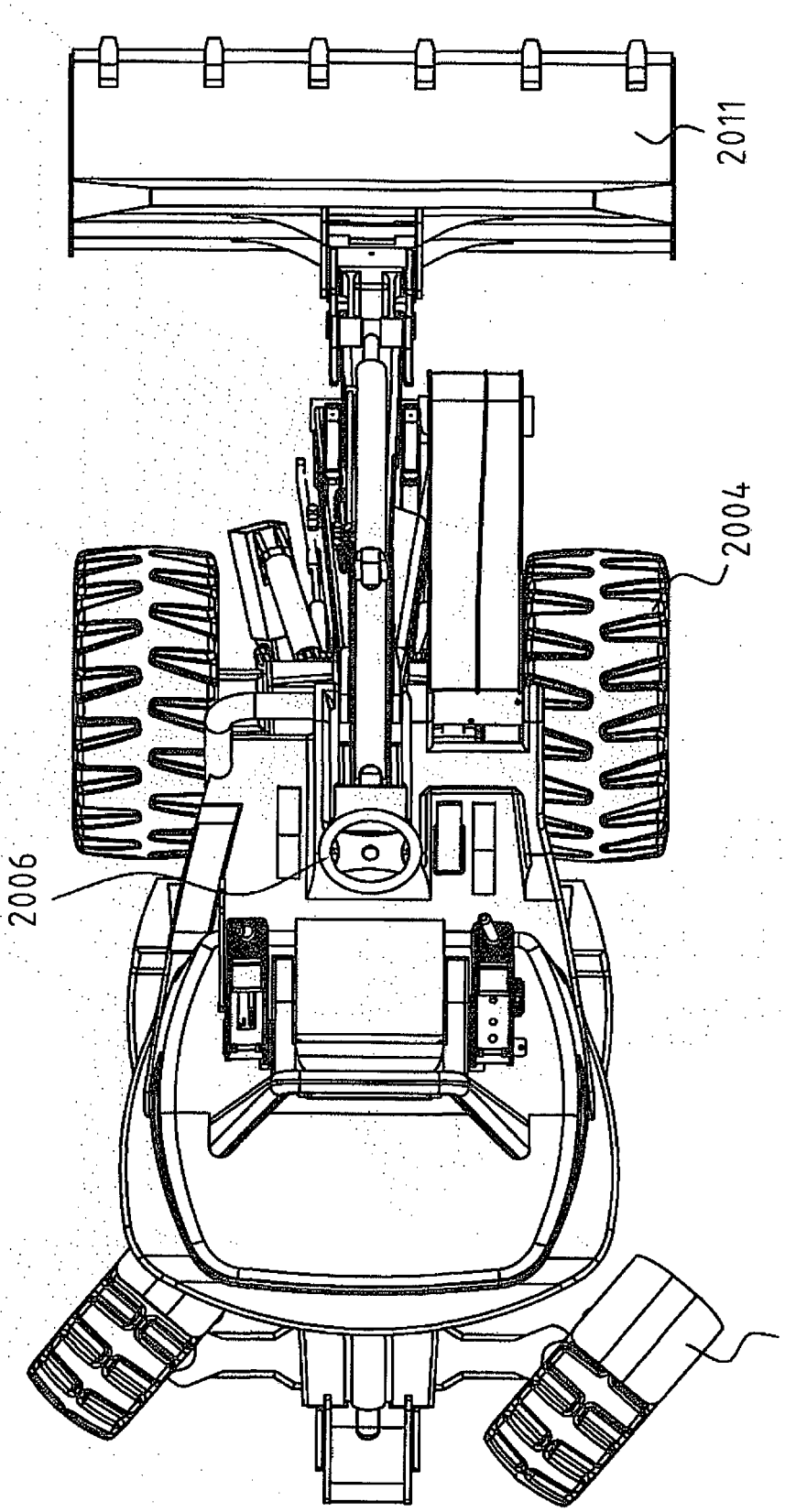


FIG. 21C

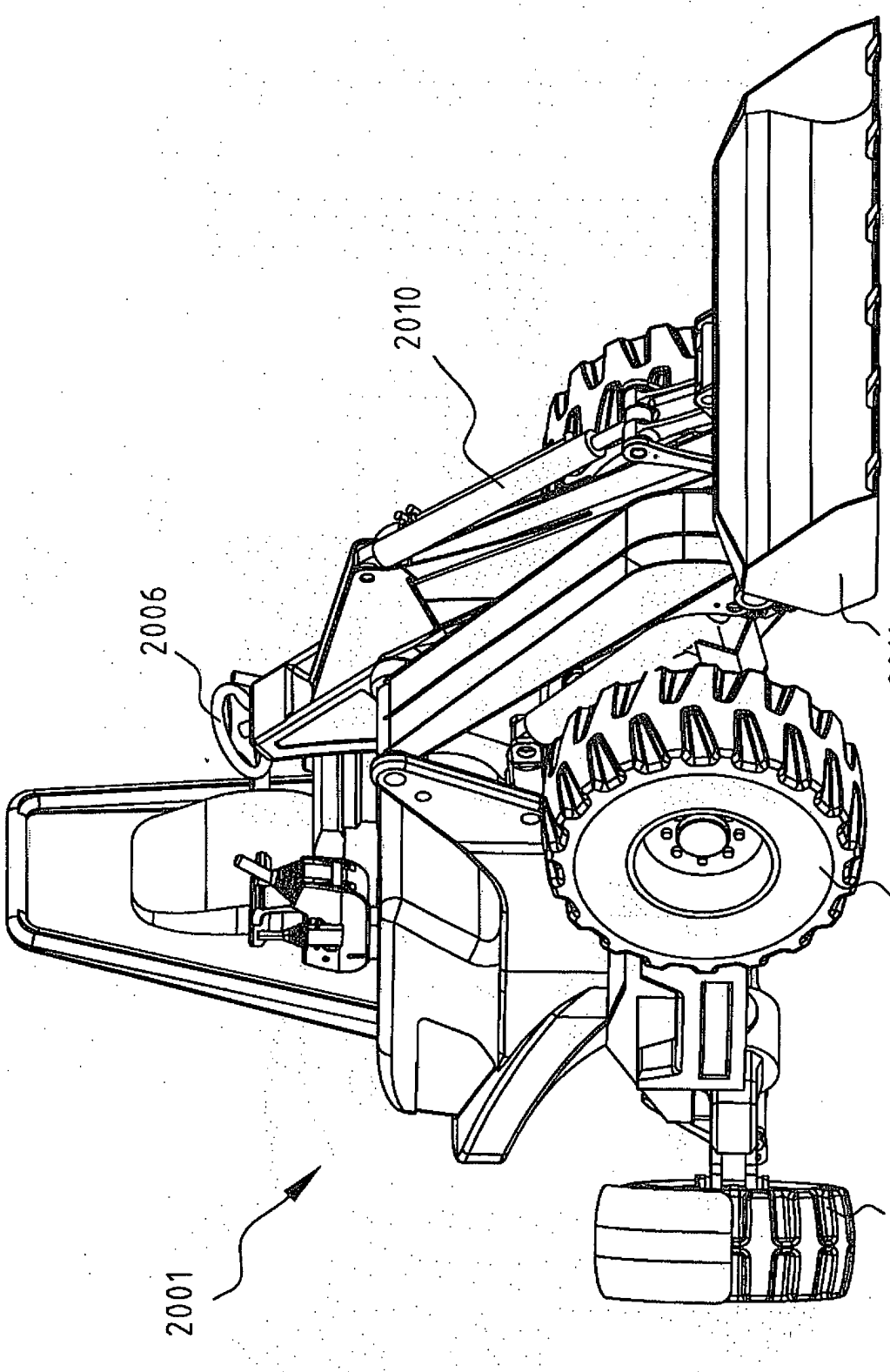


FIG. 21D

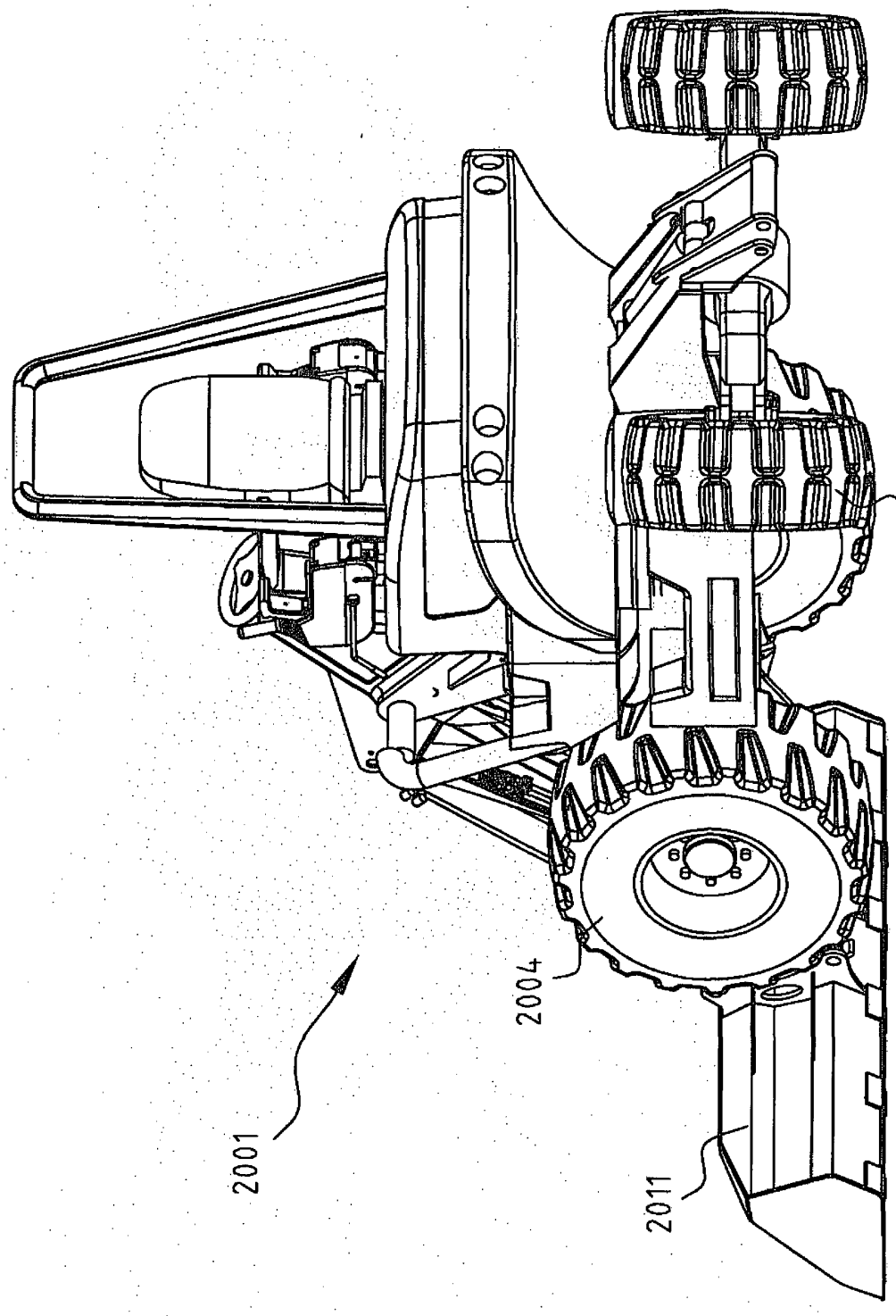


FIG. 21E

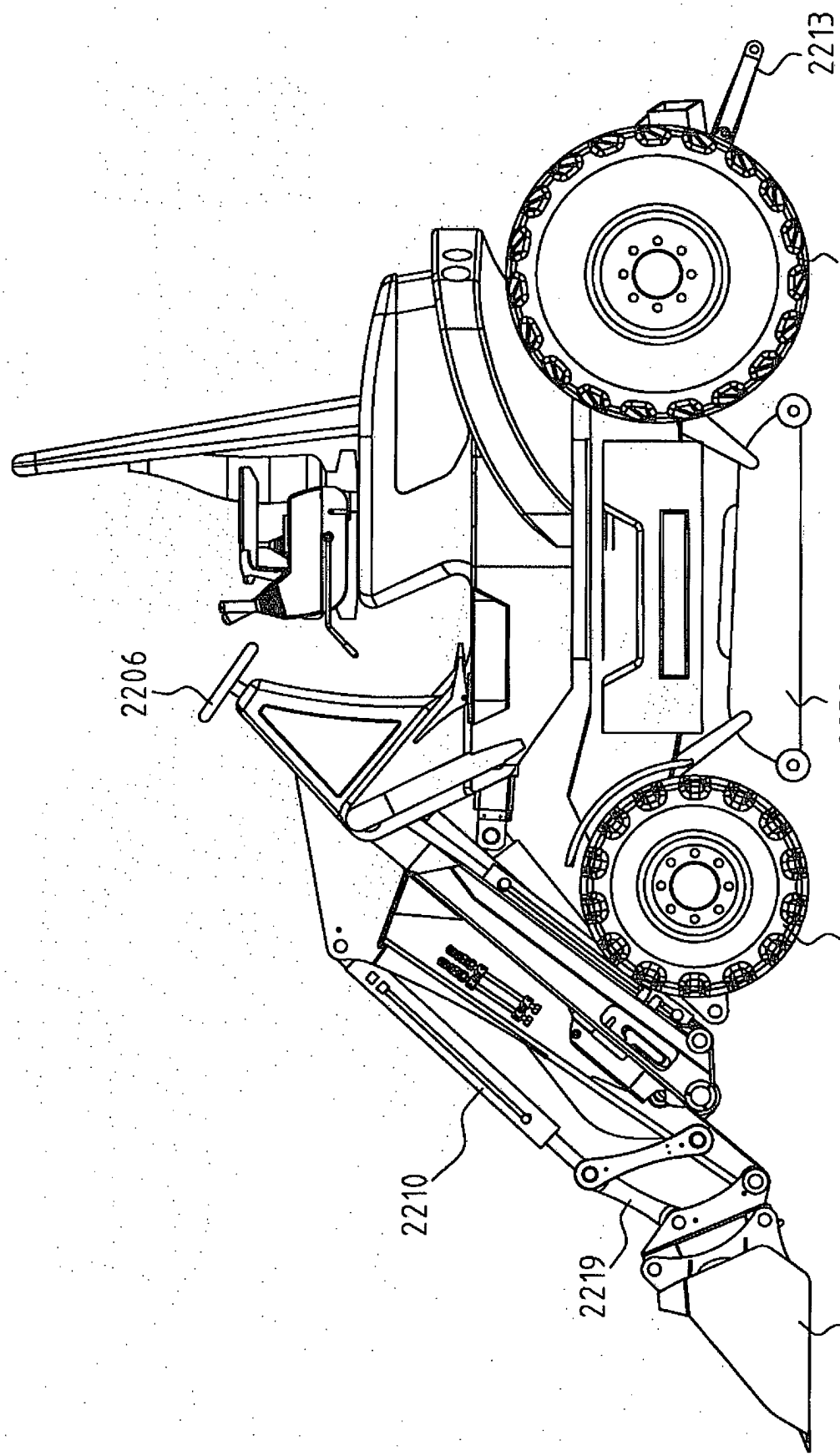


FIG. 22

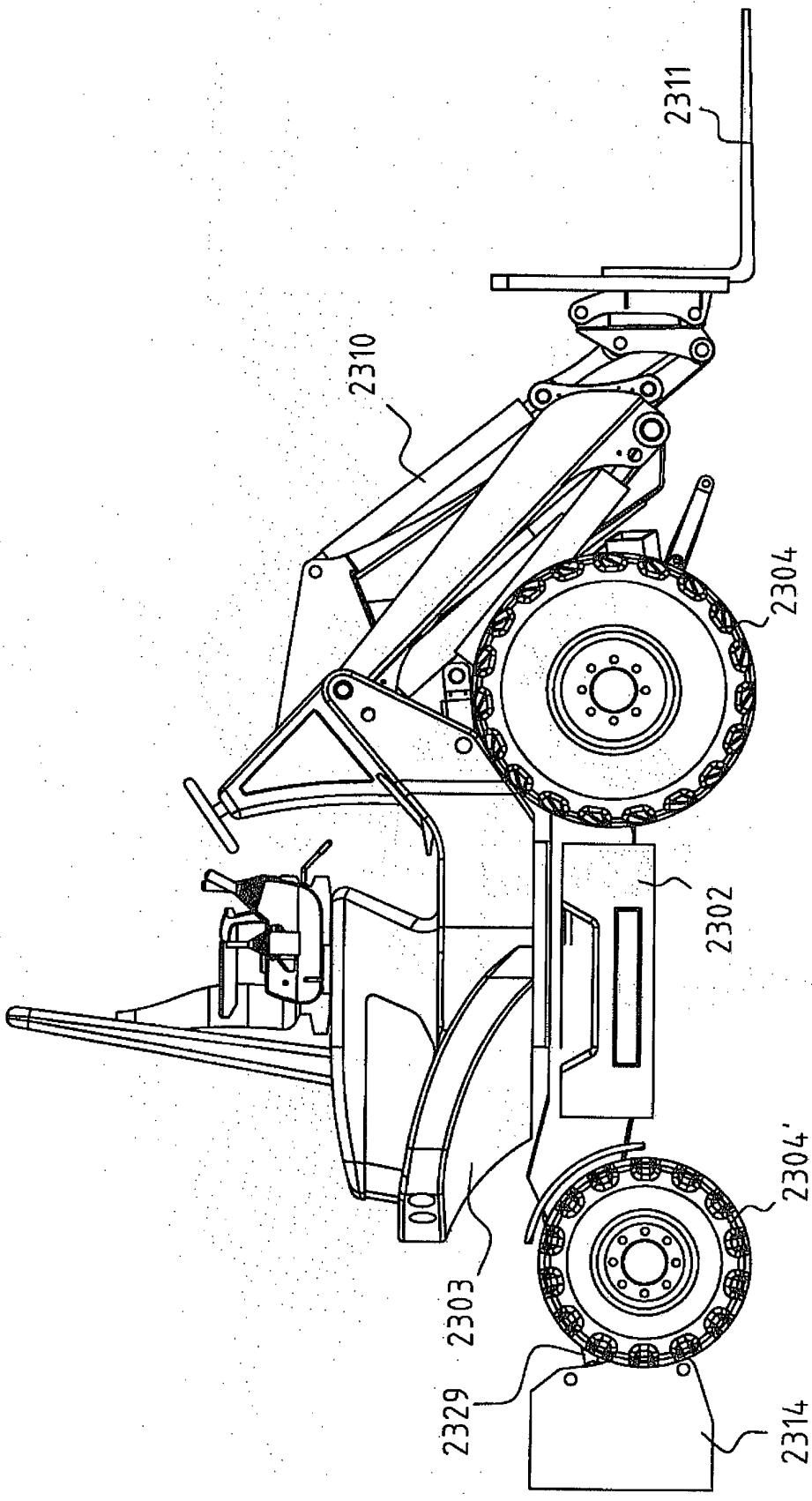


FIG. 23

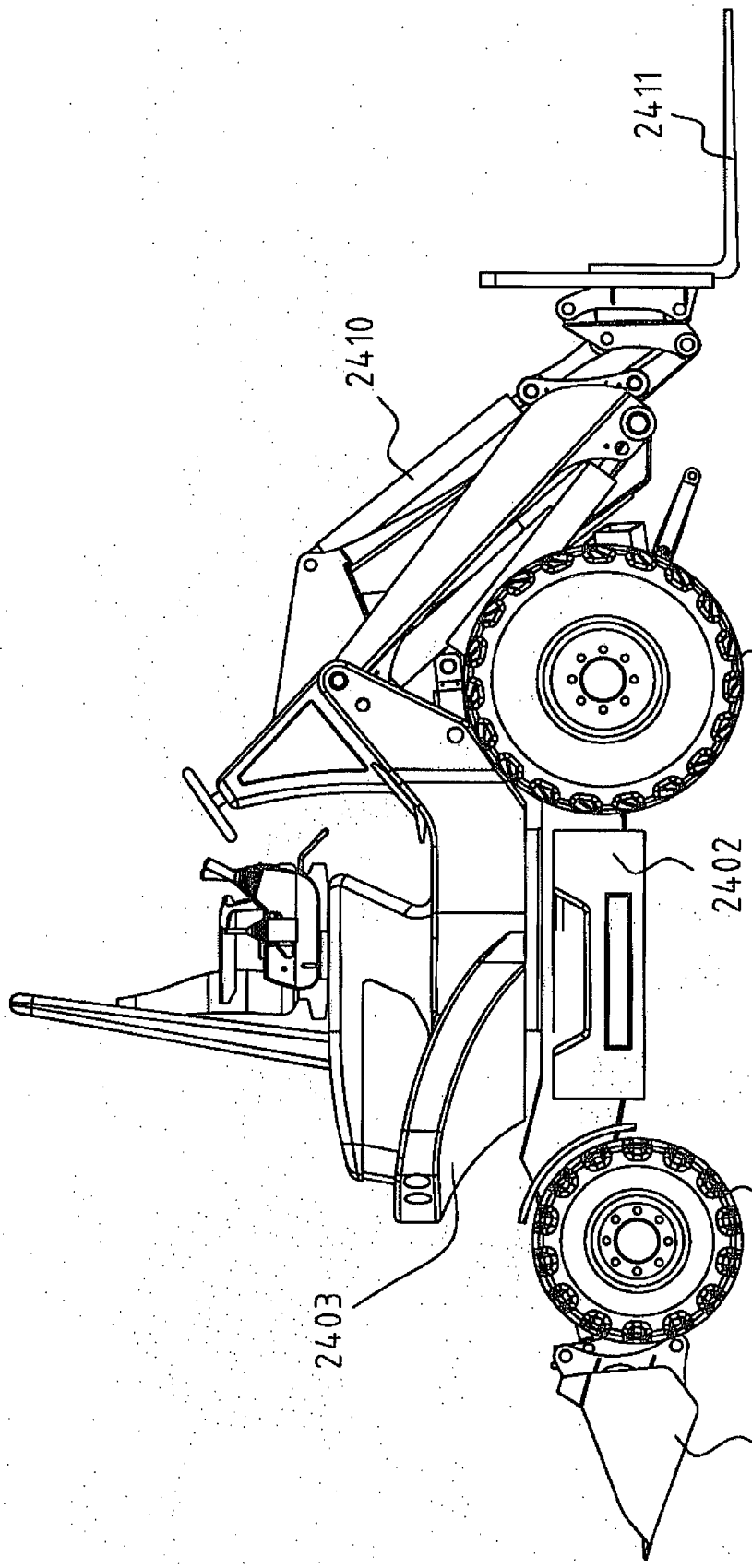


FIG. 24

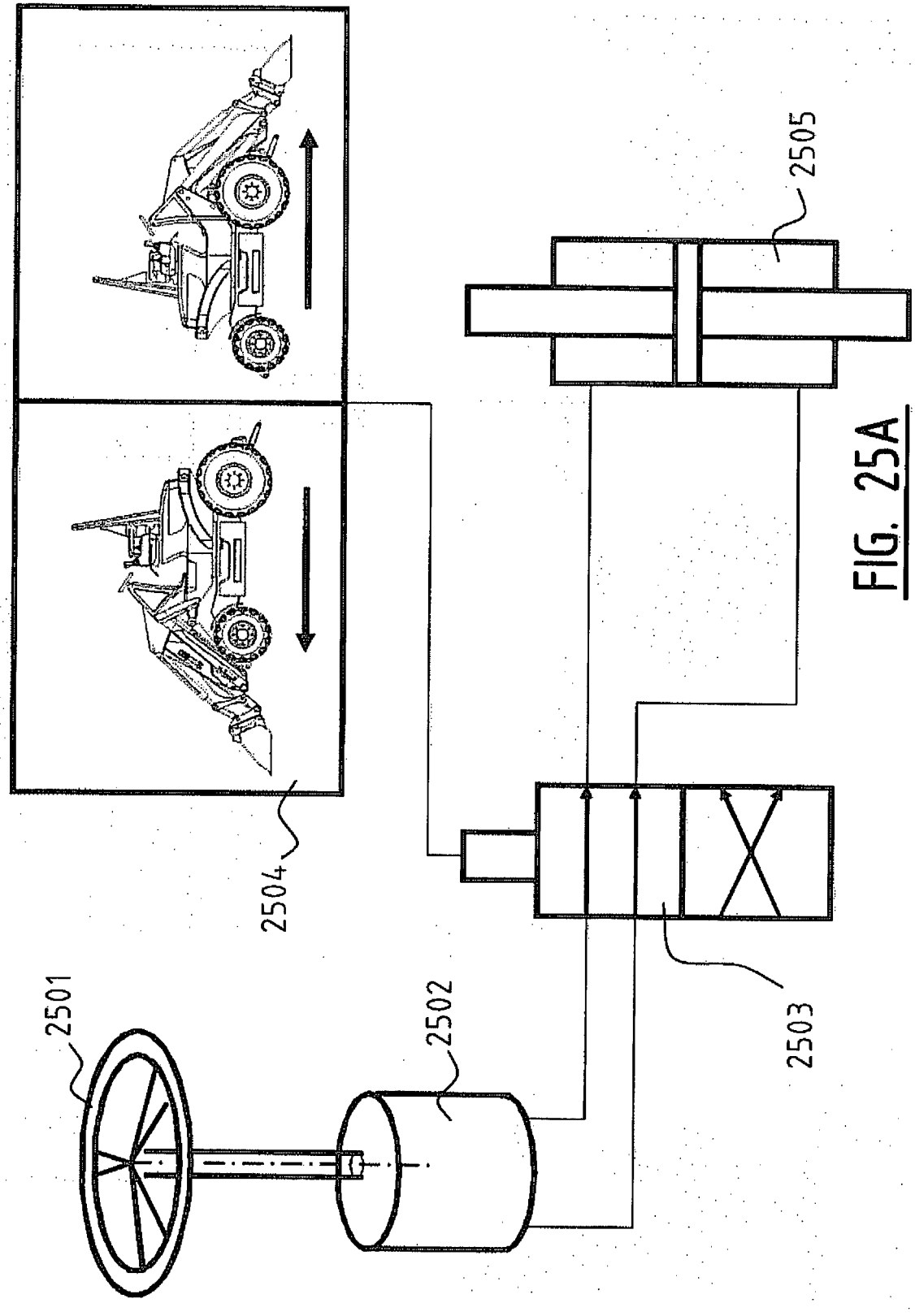


FIG. 25A

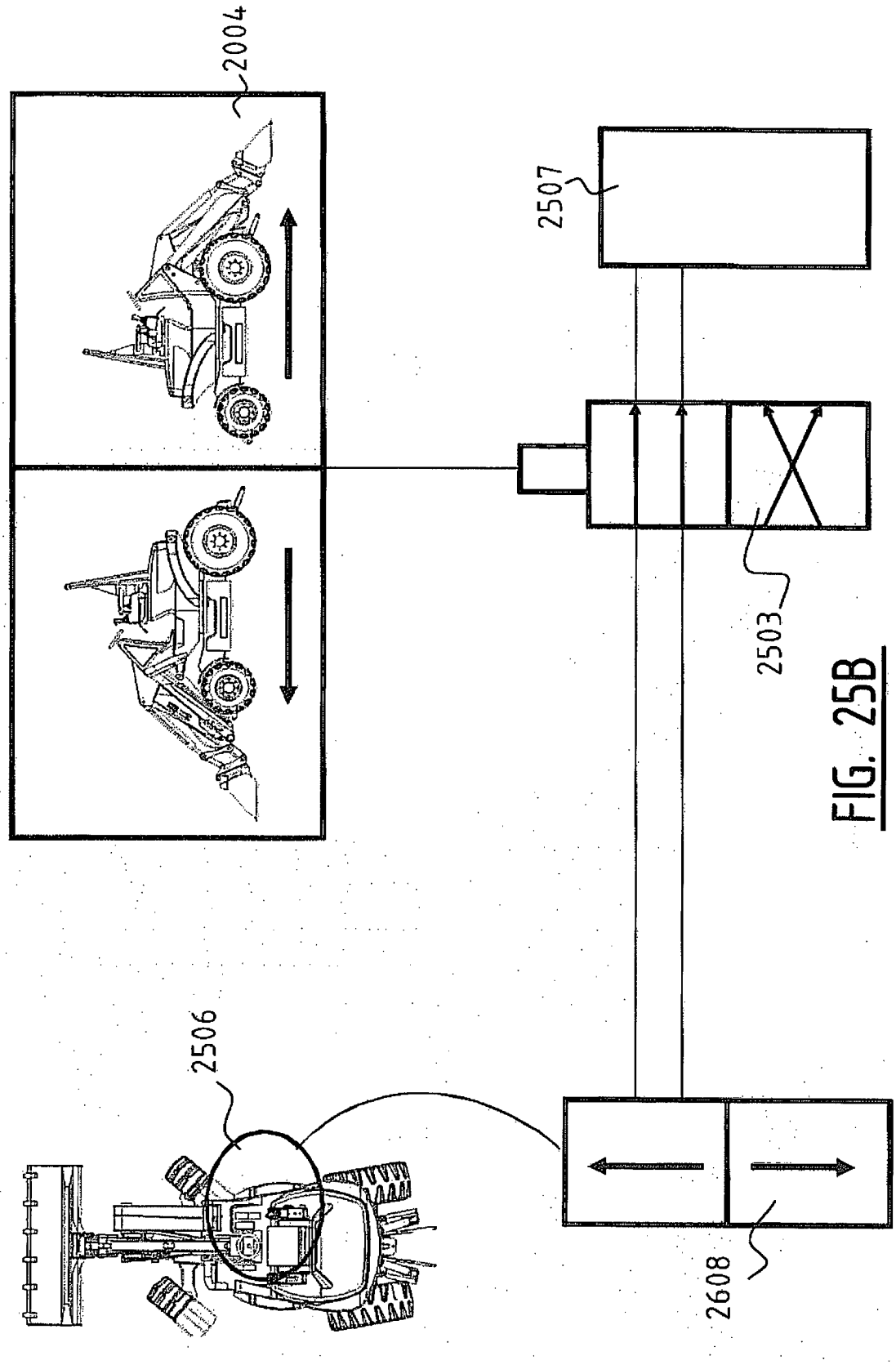


FIG. 25B

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 5265995 A **[0003]**
- EP 1472416 A **[0009]**
- EP 1245739 A **[0010]**
- EP 0740023 A **[0010]**
- EP 1818460 A **[0010]**
- FR 2727998 **[0010]**
- NL 1028661 **[0021]**